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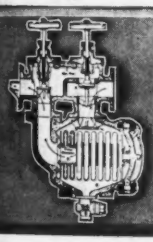

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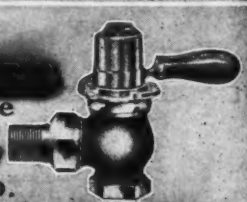

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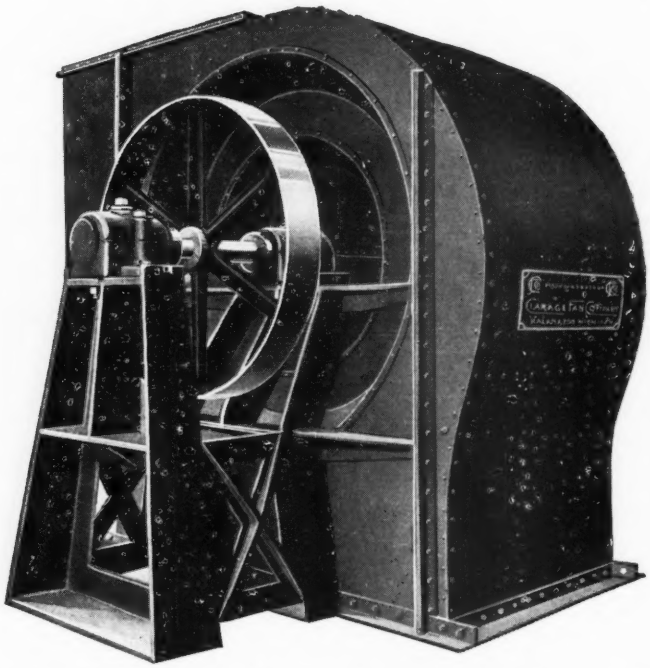

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THE HEATING AND VENTILATING MAGAZINE

SEPTEMBER, 1919

THE FUEL OUTLOOK

A Program for Coal Conservation Based Upon an Extended Analysis by Government Experts.

To say that some radical changes are coming in the use of coal both for power and house-heating purposes is expressing it mildly, according to the expert view of one of the government departments which has recently completed an extended study of the situation. The conclusions reached have now been put into concrete form by Chester G. Gilbert and Joseph E. Pogue, of the Division of Mineral Technology, United States National Museum and published under the title of "The Energy Resources of the United States: A Field for Reconstruction."

It is, of course, well known that the supply of anthracite is being rapidly depleted and that in the coming years, long before the supply runs low, its cost will have advanced to a prohibitive point, as far as its commercial use is concerned. It is not so well known that the present-day methods of handling and burning bituminous coal are so wasteful that they must be changed in the not distant future.

As with so many other things, it took the World War to drive home the fact that on two points alone present methods of handling and burning coal must stop. One of these points is the needless labor and needless transportation, resulting in an undue burden upon the railroads besides adding to the ultimate cost of coal to the consumer. The other point is the failure, in the average plant, to make any use of the latent values in the raw coal. For instance, in 1915, before the price of coal commenced to soar, the average value of bituminous coal at the mine was $1.13 a ton. Based on this figure the latent values contained in an average ton of raw coal include:

1500 lbs. smokeless fuel.....	$5.00
10,000 cu. ft. gas, at 90 cents per 1000.....	9.00
22 lbs. ammonium sulphate, at 2.8 cents.....	.61
2½ gal. benzol, at 30 cents...	.75
9 gal. tar, at 2.6 cents.....	.23
	$15.59

This expresses the situation in a nutshell and the point is made that obviously there should be a way for the home to get its fuel more cheaply than it has, when a ton of coal selling at $1.00 at the mine contains about $14.00 worth of commodities useful to society.

As far as the transportation problem is concerned the government experts advocate the development of hydroelectric power which would "not only relieve an unnecessary reliance upon our transportation systems, but it would also reduce the power use of coal to a portion more amenable to smooth co-ordination with the parts employed in the coal-products industries and the home."

COAL UTILIZATION THE POINT OF LOGICAL ATTACK.

But when it comes to coal utilization there is no hesitation in the statement that

here lies the point of logical attack upon the coal problem. It is in the home that conditions are the most discomforting in times of stress, that trouble, whether due to high prices or actual shortage, has the least chance of remedy by industrial enterprise.

The homes of the country are insistent upon anthracite, insofar as its use is not precluded by the expense or excessive distance from the area of production in Pennsylvania. But its cost of production is approximately twice that of bituminous coal. For this reason and because it emanates from one region only and does not yield by-products to modify its cost, "it must be dismissed as not equal, or adapted, to the task of supplying the American home."

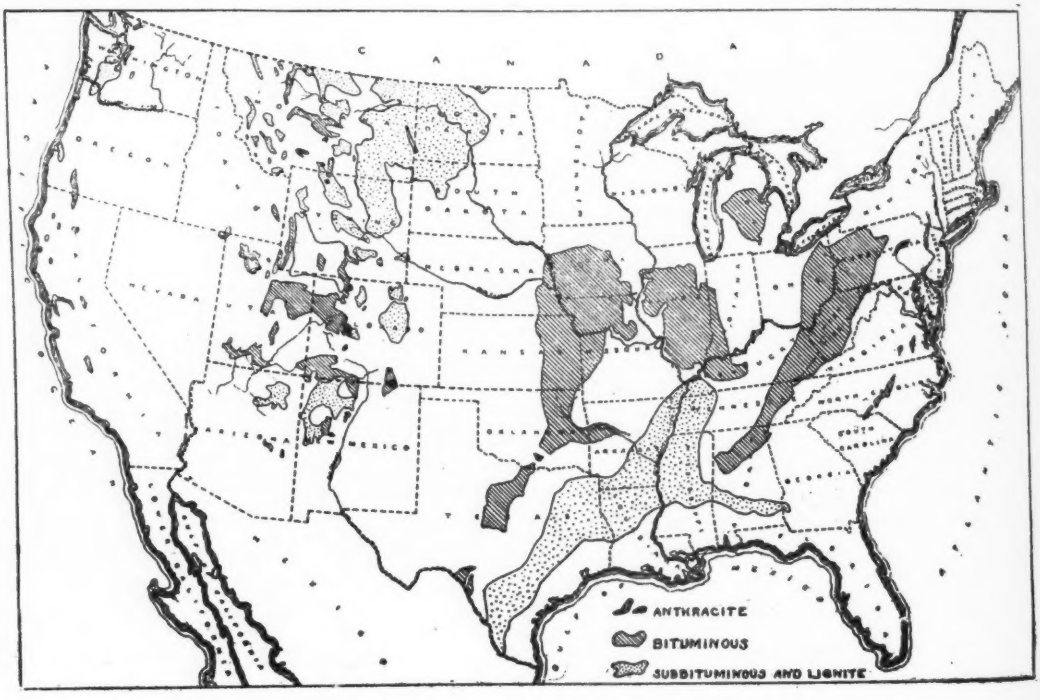
These are strong words, but the experts go even further. The home, therefore, they say, independently of its wishes in the matter, must turn to bituminous coal for its fuel dependency. There is no alternative. Already this has happened to a partial extent. War conditions have accelerated the change and the future demands it more completely.

The advantages of bituminous coal are well known—its relative cheapness, its wide distribution, its ample reserves, and the possibility of improved utilization. But there is one grave objection to the use of bituminous coal—its dirtiness.

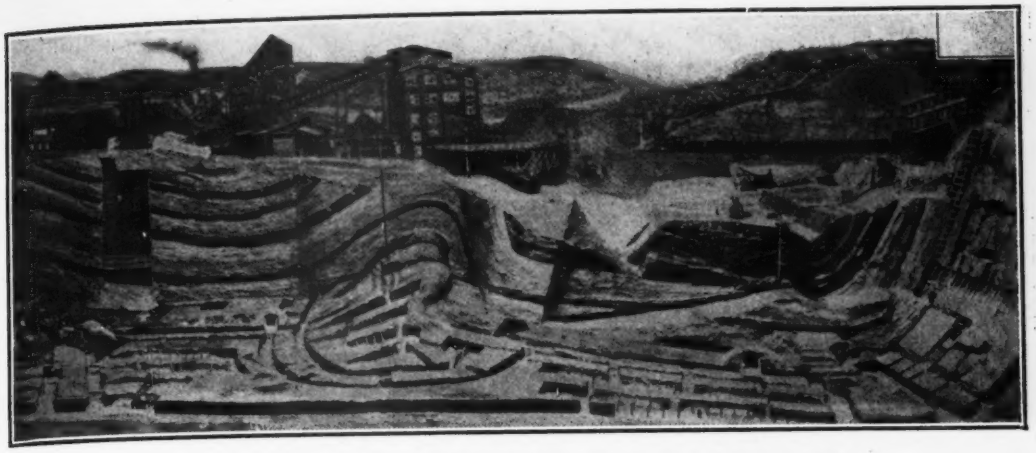
Here is the rub and the energies of the experts are concentrated in devising a method whereby soft coal may be made suitable for domestic use, not only without additional expense, but with an actual reduction in cost. The dense, black smoke given off by soft coal when burned in the raw condition, it is pointed out, represents its most concentrated value. If we can extract this value and use it towards reducing the cost of fuel, at the same time making a smokeless product for heating use, the sole object will be turned into an advantage and the domestic fuel problem will be solved.

DEVELOPMENT OF ARTIFICIAL ANTHRACITE PROPOSED.

One proposition advanced as to how these values may be obtained in full from coal is the development of artificial anthracite. This accomplishment depends merely upon the establishment of a process which will isolate the solid-fuel por-



DISTRIBUTION OF THE COAL RESOURCES OF THE UNITED STATES.



THE OCCURRENCE AND MINING OF ANTHRACITE COAL.
Photograph of a Model Published in U. S. National Museum Bulletin.

tion of bituminous coal in the form of a substance equivalent to anthracite, and produce from the remainder a number of products whose value could be made to more than carry the expense of the operation. Nature has pointed the way with anthracite, which was originally bituminous coal, but has lost its volatile portions, forced out by pressure and heat.

The important statement is made that there are no insuperable difficulties in the way of such an accomplishment. Several processes capable of this attainment are already in course of development, although comparatively little organized research has been directed to the problem.

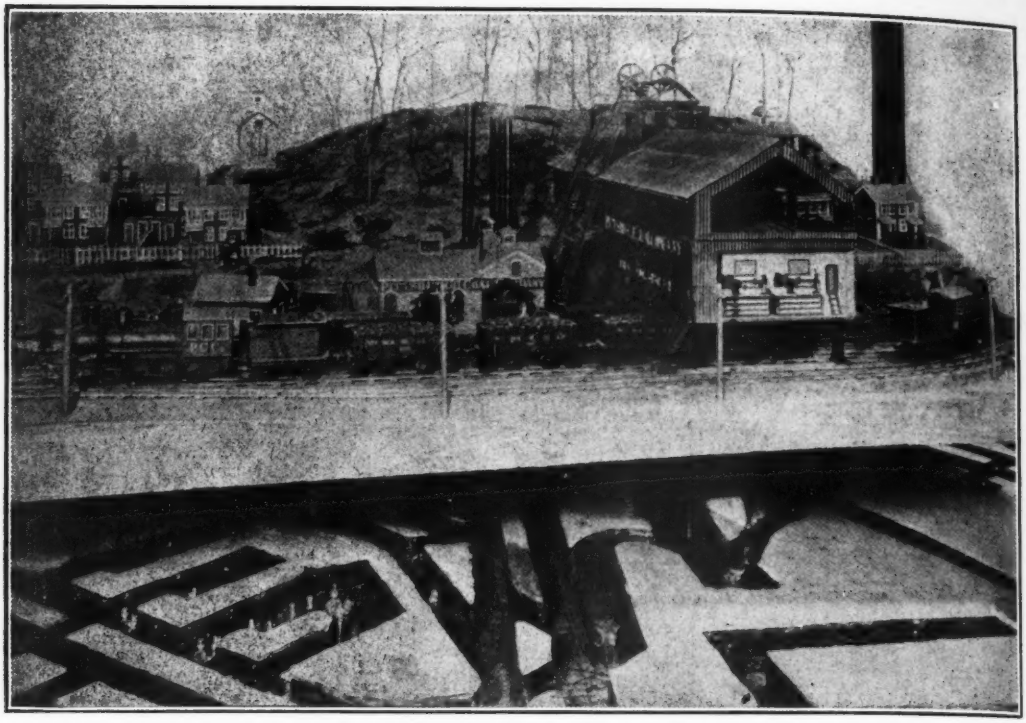
LESSON TAUGHT BY THE COKE INDUSTRY.

The most conspicuous example of what may be done in this direction is furnished by the coke industry which at the present time consumes nearly one-sixth of our bituminous coal. Most of the coke output, however, is absorbed at present by the iron industry. Coke, as is well known, is made by heating certain classes of bituminous coal at high temperatures, resulting in the production of a hard, porous residue composed essentially of carbon. Two methods of manufacture are in general commercial use. Of these, the beehive oven delivers a product well suited to metallurgical use, but the process is objectionable because of the waste involved, as it effects no recovery of other valuable constituents.

On the other hand, the retort, or by-product ovens not only produce coke but yield the by-products already listed in the early part of this paper.

It may well be asked why by-product ovens have not come into more general use. For one thing, they are complicated and costly to install and operate, but the real reason for the lagging growth of by-product coking in America is that there has not been a sufficient demand for all five of the products, due to inadequate industrial utilization of gas and the practical lack of a coal-tar industry. Until now, only two of the products had a stable demand, coke and ammonia. The gas has a varying value from a product representing the chief source of revenue in some instances down to one giving returns too small to justify its storage. The benzol, a few years back, was not even recovered. The tar, like the gas, had a considerable, though low, range in value, but until a few years ago it was scarcely profitable to extract it.

But even with an adequate expansion of the coal-products field, the fact remains that coke is not a satisfactory fuel. While smokeless in combustion, its cellular structure gives it an intensity of combustion and susceptibility to chill that makes it hard to control. Even a radical change in furnace construction will not overcome this difficulty. Moreover the coke industry is centralized, subject to marked fluctuations according to the demand for iron, and has not yet succeeded



THE OCCURRENCE AND MINING OF ANTHRACITE COAL.
Photograph of a Model Published in U. S. National Museum Bulletin.

in modernizing more than half of its practice.

Metallurgical coke, then, must be dismissed as an impracticable general-service fuel. The by-product coking practice, however, illustrates the principle of full coal-value utilization and therefore points the way toward progress in respect to fuel coal. Modified by-product plants, simpler than by-product ovens, producing a non-cellular carbonized residue and located near the points of utilization, represent the lesson to be drawn from the coke industry.

SOLUTION OF PROBLEM FURNISHED BY GAS INDUSTRY.

Turning to the gas industry the experts find that although the municipal gas plant now meets rather inadequately only a small share of the fuel needs of the community which it serves, it represents an established activity which can be converted into an organization that will supply all the fuel, whether gaseous or solid, that the community requires. At present this industry consists of a great number of plants distributed among the cities of the country. In the aggregate these plants consume about 1 per cent of the annual coal production of the country. (The heating industry uses one-sixth of the country's coal output). The prime purpose of the gas plants is to manufacture gas and this they do without adequate regard to the complete recovery of by-products, although many plants effect a partial recovery of ammonia and tar, and some gas-house coke is put upon the market. Apart from the oil-gas plants on the Pacific coast, in which petroleum is used, because of its relative cheapness in that region, the artificial gas industry of the country employs coal as its raw material.

Three types of gas made from coal are in general use—coal gas, carbureted water-gas, and mixed gas. Coal gas is distilled from bituminous coal by heating the latter in retorts. Carbureted water-gas is produced as a result of the action of steam upon coke or anthracite, the non-illuminating water-gas thus produced being then "carbureted," or enriched, by

the addition of a gas of high thermal and illuminating power made from oil. Mixed gas is a mixture of coal-gas and carbureted water-gas and is supplied in many cities in the United States, the coke from the coal-gas production furnishing the basis of the water-gas manufacture.

The gas companies are by nature and in fact public utilities. They manufacture a necessity which does not lend itself to competition. They are private enterprises under municipal control, which is largely directed, however, to price restrictions, and is not constructive in the way of compelling advances in technical procedure. With some exceptions, the average municipal gas plant is a small and antiquated organization, both in practice and in vision, far behind present possibilities of manufacture and application. In some cities in the United States, the gas companies are in the nature of large public-service corporations, which have made considerable advance in gas production, but nowhere is there full by-product recovery and the price of city gas is uniformly high.

That gas plants may be transformed so as to retain the gas mains and much of the other equipment, and at the same time have added to them a by-product system of coal distillation, producing artificial anthracite, gas, ammonia, benzol and tar, is declared to be entirely practical. This will mean in each city a centralized purchase and consumption of raw coal, and a centralized distribution of products. The output will be limited at first, at least, by the demand for solid fuel. A production of ample solid fuel will give an excess of gas over that now produced, which will call for an expansion in the use of gas, both in the home and in industry. Such expansion will come as a result of cheaper gas, incidental to the proposed plan of production, together with improvements in methods of utilization; and this very expansion will cut down the use of solid fuel and thereby hasten the adjustment. The three remaining first-products, ammonia, benzol, and tar, have an unlimited field of usefulness as such, even within the municipality; and by shipment will contribute a supply of raw material to the needs of the coal-products industry, thus permitting and inducing this important field of endeavor to advance beyond the limits now imposed upon it by the coke industry.

The objection may be advanced that artificial anthracite has not been perfected and placed on a commercial basis, and until such time the utilization as outlined above must wait. It is true that such a process is not worked out in detail and ready to be fitted into the present gas industry, but a similar condition has been a stage in the development of practically every technological process and the recognition of the demand has created the means for its accomplishment.

But even granting the objection as valid, the experts find that the production of artificial anthracite is only one of two solutions to the problem of developing an adequate smokeless fuel from bituminous coal. The prime idea is to separate the heat or energy-producing portion of the coal from the constituents valuable as commodities, and dispose of the two groups to their mutual advantage. Hence if we convert the energy component entirely into gas and recover the by-products, we may accomplish our purpose without calling into service a single procedure which is not already in successful practice in other fields of industry. The municipal gas plant affords, in the second instance also, the logical point of attachment for the development. Only, in this event, in the place of artificial anthracite and gas, plus ammonia, benzol, and tar, the output would be gas entirely, with a similar production of ammonia, benzol, and tar.

GAS AS A FACTOR IN THE FUEL PROBLEM

The twofold possibility of advance in coal utilization brings up the relative advantage of a solid, smokeless fuel versus a gaseous fuel. Their applicability for domestic use may be examined first. Solid fuel, such as artificial anthracite, requires no change in present types of furnaces and grates; is applicable to suburban and out-lying districts not served, or servable, by pipes; and will always be in demand for open fires. Gaseous fuel, on the other hand, eliminates the factors of storage and haulage, reduces dirt, and through the automatic temperature control of gas-fired furnaces nullifies the conspicuous

NEGLECTED OPPORTUNITIES INVOLVED IN THE WASTEFUL USE OF COAL IN THE UNITED STATES.

[All figures in round numbers and on an annual basis.]

PRESENT ATTAINMENT.		POSSIBLE ATTAINMENT.					
Coal inadequately used under present conditions (1918).	Recovered under present conditions.	Available under present technical knowledge and ultimately recoverable under stimulus of constructive economic policy.		Loss interpreted in terms of dollars on basis of normal (1915) values.	National meaning of loss under present circumstances.		National gain from correct practice.
500,000,000 tons.	A small percentage of the energy.	Energy.....	At least double the present recovery. (On basis of widespread utilization of gas in place of solid fuel, etc.)	$1,000,000,000+ in needless mining and transportation of coal.	Needless burden upon overworked railways. Smoke nuisance in cities, entailing untold destruction of civic betterment attainments. High cost of coal to consumer. Resource waste.		Some relief to transportation. Complete elimination of smoke. Cheaper fuel.
		Nitrogen (ammonium sulphate).	5,000,000 tons. (On basis of 20 pounds per ton coal.)	$280,000,000.....	Serious nitrogen problem affecting field of fertilisers and explosives. Dependence upon Chile for sodium nitrate. Large expenditures for atmospheric-nitrogen plants. High cost of nitrogenous fertilisers, reflected in cost of food.	Inadequacy of coal-products industries. Problems in explosive manufacture.	Nitrogen independence, contributing to food production and explosive manufacture.
		Benzol.....	1,000,000,000 gallons.[1] (On basis of 2 gallons per ton coal.)	$300,000,000.....	Undue dependence upon gasoline as motor fuel, contributing to overproduction and rapid exhaustion of the petroleum resource.		Contribution to supply of motor fuel. Advancement of good-roads movement. Establishment of large coal-products industry. Gains in new directions to be developed by chemical research.
		Tar.....	4,000,000,000 gallons. (On basis of 8 gallons per ton coal.)	$100,000,000..... Additional value of coal-products manufactured from benzol and tar.	Neglect of roads.		
		Total..	.....	*$2,000,000,000.....	.....		Capacity for relieving cost of living $10-$20 annually per capita. Gain to American industry.

* This figure is given as a concrete expression of the magnitude of the opportunity that faces this country in respect to coal, although the significance of the prospect is conveyed more truly in the two columns to the right. The matter, of course, can not be expressed in figures without qualifications, which, therefore, must be accepted on a basis of the argument in the text. An element of double count in the summation is compensated by increments resulting from the course of advancement in multiple production.

losses growing out of ignorance and waste in connection with present hand-firing. For industrial purposes, gas offers conspicuous advantages, as evidenced by the varied industrial use of natural gas in all regions where abundance of supply creates a low price.

In general, gaseous fuel is bound to increase in importance as compared to solid fuel, especially in the industries. While solid fuel lends itsef to conversion into power only through the agency of the wasteful steam engine, gas may be used in the internal combustion engine, which for the same equivalent consumption delivers in general over twice the power, while for the purpose of producing heat, gas presents an ease of control and mobility of application that place it beyond comparison.

For domestic purposes, however, the advantages of solid and gaseous fuel are somewhat complementary, rather than opposing, so that advances toward perfecting the two types of fuel may well be simultaneous. The successful operation of an artificial anthracite plant will demand increased utilization of gas, involving the employment of the latest advances in its application, while the operation of an enlarged municipal gas plant, with adequate by-product recovery, however, effective in the way of economical gas supply, cannot be expected to replace fully, at least for some time, the need of a smokeless solid fuel.

In either event ,therefore, the tendency will lead toward an increased role for fuel gas, a trend in line with the inevitable necessity for a more mobile and more efficient source of heat and power than is afforded by solid carbon.

PUBLIC INITIATIVE NEEDED TO' FURTHER PLAN.

The successful launching and operation of either of the two plans proposed will depend upon public initiative and stimulus. The first move, therefore, depends upon the public, or at least upon organizations representative of the public interest. The accomplishment, however, will call for a more effective administration of public utilities than has obtained in American cities in the past, and this will come only after full public realization that technical affairs must be directed by technical knowledge.

EXPERIENCES IN USING BITUMINOUS COAL AS A SUBSTITUTE FOR ANTHRACITE

Changes Made in Firebox Boilers That Proved Effective, With Suggestions for Further Improvements.

BY A. BEMENT.

The stress of war conditions which compelled the use of bituminous coal, in place of semi-bituminous and anthracite coal, while resulting in considerable measure of hardship in heating service, has pointed to possibilities of important advantages in the use of such fuel, and it remains to be seen whether the experience will be taken advantage of.

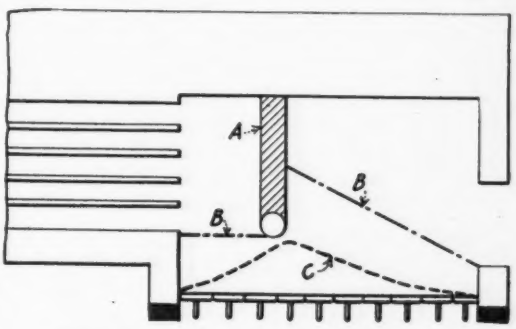
The common style of furnace which consists of the plain grate, either stationary or shaking, came into vogue when anthracite was the universal fuel, and with such coal, results were very satisfactory. So much so that such furnace design became standard, and as heating boiler manufacture began in the East, the Natural anthracite territory, this eastern practice extended westward with the result that the coal followed the furnace into fields where bituminous coal would have been the logical fuel to use, if the furnace had been suited to it.

As the price of anthracite increased, fuel costs became prohibitive in these far-away localities. Then following the natural law of supply and demand, a substitute in the form of semi-bituminous or Pocahontas coal came into use in place of anthracite. While this fuel is inferior for the purpose to anthracite, it did well enough to get by, but when war came and most of the public had to go to bituminous, or soft coal, the device which was all right for anthracite and could get by with semi-bituminous proved to be most unsatisfactory with the soft coal. But the efforts made to adapt conditions suited to this coal are both interesting and instructive. These efforts were of two kinds, one consisted in an endeavor to manipulate the fire in some manner that would give a better result, with the equipment at hand, and the other was to change the firebox when practicable. Such measure of success as secured has been largely with the changed furnace.

It is obvious that there is little or no opportunity to change the firebox of the usual boiler that is installed in residences. In apartment house service, however, where the steel boiler of the locomotive type, known as the firebox boiler, is so extensively used, it has been possible to do some very effective work in the way of converting it into a form of down-draft furnace. The illustration represents a sectional view of such firebox in which what is generally known as an arch has been placed, as shown by A. Generally these arches rest upon, and are supported by a horizontal water-tube connected to each side sheet of the firebox, through which water flows. These arches are made of fire-brick material, fitting tight against side and crown sheets, and, in some instances, are perforated with holes to allow the passage of air for the purpose of assisting combustion back of the arch.

OPERATION OF FURNACE, WITH ARCH INSTALLED.

To describe the operation of the de-



FIRE-BOX BOILER CONVERTED TO A DOWN-DRAFT FURNACE.

vice, it is assumed that the fire has burned down so that its surface is represented by the line C, when this has occured, it is time to clean and replenish the fire. The first operation consists in raking the fire forward, away from the arch. Then with a hook, the clinkers are removed, and pulled out of the door. The fire is then pushed back under the arch as much as possible and piled up against it. Fresh fuel is then added so that the surface assumes the position shown by B, with a heavy charge of green coal sloping from the door up against the arch in the front, and hot coals under the arch in the back. Under these conditions there is no sign of fire to be seen in the firebox, but of course combustion is proceeding below and back of the arch. The fire is now left till it has burned down to the position C, when the process is repeated. This period varies from 4 to 24 hours, depending on conditions and efficiency of the installation. Twice in 24 hours is a common record in cold weather for a good installation.

It is apparent that the only outlet for the combustion gases is under the arch, and the fire being at the bottom of the fuel bed, it necessarily follows that as the fire works up and back into the green coal, that the gases generated must pass among the hot coals below the arch.

Air supply all comes from the ash-pit. In some instances a special passage is provided from the ash-pit to a point above the fuel charge, so that a flow of air above the fuel is provided for. In other cases the air works into the fuel bed from the pit, and under the arch. In all cases the air supply is controlled by the regular diaphragm regulator. If steam drops, the draft is increased and the fire burns faster; when steam rises, the draft is reduced and the fire burns slower, and if the demand for steam ceases, the draft is entirely cut off and the fire becomes banked. For these three conditions of draft and steam demand, the same quantity of fire is present. It is simply burned slower or faster according to demand. Thus the attendant does not fire up when more steam is required, nor does he carry a low fire in mild weather, or when little heat is needed. Adding of new coal has no relation to the demand for steam. The time to replenish the fire is when it has burned down to the point when there still remains a sufficient amount of red coals to fill up under the arch, and bank up against it.

DIFFERENT METHOD OF CLEANING FIRE.

Cleaning the fire is a different process than with the surface burning fire. In the down-draft process the ash accumulates at and below the arch, which is the hottest point. The result is that the ash is melted into clinkers, and cleaning consists in first shaking the grate, then raking the fire forward so that the larger clinkers can be pulled out with a hook. No attention is given to the small ones, they are left to be fused into larger ones to be gotten the next time. Thus aside from shaking the grate, cleaning the fire consists simply in removing the large clinkers. In the ordinary surface-burning fire, large clinkers are objectionable, while with this adaption of the down-draft fire, they are desirable, because it simplifies ash removal without seriously disturbing the fire, which would result if the grate were thoroughly cleaned.

It is apparent that the volume of space available for combustion is much reduced with the arch, as compared to that without the arch when the entire grate surface is employed. This requires that a good draft shall be available for good results with the arch. It has been found from experience that a draft of 0.20 in. water column, measured at the outlet of the tubes of the boiler, is necessary for good results, and many failures with these installations have resulted from ignorance of or neglect of this important requirement. Most of the people who have installed and exploited this form of device are novices, not familiar with combustion requirements, and they have attempted to do the work at an unduly low price. The result has

been that when the setting, the regulator, etc., were not in good order and the draft poor, disappointment has resulted.

SIMPLE CURE FOR POOR DRAFT.

Poor draft is usually due to small and complicated passages between the boiler and chimney. One of the simplest cures of low draft consists in removing the horizontal partition, sometimes called the combustion arch, which is set at the back end of the boiler just above the tubes. This gives a direct passage to the chimney, instead of carrying the gases back around the outer surface of the boiler. This has not only been found to strengthen the draft, but also to increase the boiler efficiency. With a good equipment of this character a boiler may be operated with no smoke, at better efficiency, with less labor, and at less cost when using soft coal, than with the best smokeless coal. One of the difficulties encountered, however, is that many of these boilers are so set that the back end is not accessible for cleaning the flues, and the presence of the arch makes it impossible to do so from the front. In some cases it is possible to install a rear clean-out door. In these cases, however, where no rear clean-out is available, fouling of the tubes may be a very serious matter where the draft is defective, or when the furnace is improperly operated. In an effort to overcome this difficulty, efforts are being made to devise a movable arch to allow of cleaning tubes from the front.

CHANGES IN EQUIPMENT CONFINED TO FIRE-BOX BOILERS.

Changes in equipment have practically been confined to the fire-box boiler as above described, because of features of design, proportions, and construction which have prevented changes in the usual residence boiler. With such equipment, about the only thing that could be done was to change the method of firing, or the size of the coal used. An improvement in firing was effected by pushing the fire back and putting the fresh coal on the front, or one side, this helped to burn the smoke. Nut size of coal gave best results.

OLD CONDITIONS OF FUEL SUPPLY WILL NOT RETURN.

The matter of changes in present, or the installation of proper equipment, has not had serious consideration on the part of the general public. People generally have made the mistake of believing that old conditions of fuel supply would return. That this is not true is readily apparent when the facts are intelligently examined. In the first place, fuel prices have, and are still increasing. This compels purchase from the local fields. The demand for the smokeless fuel from certain sources, such as coke manufacture, marine use, etc. to which this fuel is especially adapted, will withdraw it from the markets in question. Bituminous operators are beginning to realize that their fuel, with proper equipment, is superior to that of the smokeless variety, for the service in question, and they will use their influence to have withdrawn the preferential freight rates that the smokeless fuel has enjoyed.

MEANS FOR SLICING FIRE ESSENTIAL WITH DOWN-DRAFT BOILERS.

The well-known down-draft boiler, while not a war measure, is something which should be discussed in this connection. It is unfortunate that the manufacturers who copied the old Hawley down-draft furnace in their boilers, did not incorporate the features that experience had shown to be essential. Instead of doing so, most of them simply utilized the water-cooled grate, which they applied to their regular design. The first essential is a means for slicing the fire. This requires provision for the insertion of a slice bar parallel with and in contact with the grate, in such manner that the ash will be dislodged and dropped through the water grate, at the same time freeing the fire without disturbing and spoiling it. One of the well-known boilers complies with

this requirement, but the space above the water bars is so low that it is not only impossible to maintain a sufficient depth of fuel, but to even get the coal into the space.

Other types have sufficient fuel space but no provision for slicing the fire.

LOWER GRATE SHOULD BE STATIONARY.

Another mistake that has been generally made, was to attach too much importance to the lower grate, giving it too much space, and making it a shaking grate. The fundamental idea of the down-draft principal is to burn all of the fuel on the upper grate. A small portion of course, would drop through, but the great amount of matter dropping down should be ash. Best results are had when a plain stationary grate is used, because the clinkers will not shake through, and must be removed from the grate with a hoe, and a smooth grate is easiest cleaned.

CYCLE OF OPERATION FOR HAWLEY DOWN-DRAFT FURNACE.

The down-draft furnace of the Hawley type is the best furnace that can be used for heating service, if correctly designed, and it may be well to outline the proper cycle of operation of such a furnace. First, the hoe should be used on the lower grate to remove the clinkers, or the larger ones. Second, the upper grate should be carefully sliced, keeping the bar in contact with the water grate. This slicing should be over the entire surface, clear to the back. Third, the ashes and coal which fall on the lower grate should be levelled carefully over the surface of the grate. Fourth, the fuel supply on the upper grate should be replenished.

The idea is to dislodge all the ashes from the upper grate so that they do not remain to melt into clinker, and to maintain a compact, but porous, condition of the fuel bed. To maintain a uniform condition on the lower grate so that the flow of air through it will be constant. This implies that there be no regular cleaning period for this grate, but rather that the accumulation be kept to a regular stage by the removal of the surplus accumulation.

WASTEFUL PRACTICES IN HEATING WORK

Errors of Design and Operation That Help to Make Dents in the Coal Pile.

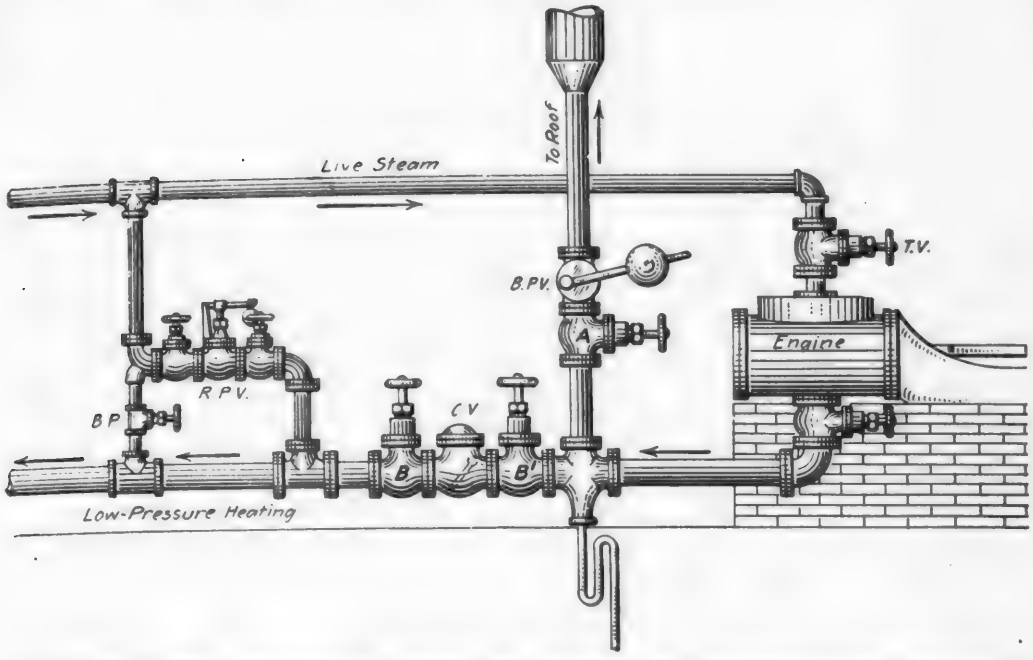
I.

BY WILLIAM J. BALDWIN.

There is one little mistake that is often made and which leads to a considerable waste of steam in many of our most pretentious heating plants. When the engines of a building make sufficient exhaust steam to warm a building, there should be no necessity for adding live steam. Where it is added, under the circumstances stated, the excess of exhaust steam will, of course, escape through the back-pressure valve and exhaust pipe to the roof. It is here that the trouble usually commences; for to provide for the times when there is not sufficient exhaust steam, a live steam connection, with its reducing pressure valve, is made with the low-pressure heating system, to make up the deficiency. It is this live steam, finding its way into the heating system and escaping through the exhaust pipe and the back-pressure valve to the air, that causes the great loss, unless the work is properly constructed and special means are taken to prevent it, and to make it impossible to have steam escape this way no matter who runs the apparatus.

'Tis said, "This is for the engineer to attend to if he knows his business," but this is not so, as there should be "no open switches" left in the work to trap him.

This manipulation and watching of



SUGGESTION FOR PREVENTING WASTE OF STEAM IN AN EXHAUST STEAM HEATING SYSTEM.

valves and gauges cannot be left to the operating engineers or the janitors and no system of pressure gauges or vigilance will entirely prevent the waste of steam, if not at all times, at very many times. The writer has known it to go on to an extent that probably one-third of all the value of the fuel used in the building was wasted in this way, the "make-up" of live steam being wasted through the exhaust pipe.

We do not presume to say that the arrangement shown in the accompanying illustration is an ideal connection, but it is diagrammatic of what we are trying to impress, namely, the advantage of admitting the exhaust steam into the heating apparatus through a swinging check valve, and using a gate valve on each side of it, so that we can be sure that no live steam will get to the exhaust pipe during the day when the engine is running, or at night when it is idle. The valve "A" should be closed when the engine is not making sufficient steam to fill the apparatus, and the valve "B" should be closed when the live steam alone is being used.

II.

BY T. W. REYNOLDS.

The accompanying photographs show

FIG. 1—WASTE OF STEAM CAUSED BY UNCOVERED STEAM PIPE.

evidences of waste of steam which are not at all unusual. Fig. 1 illustrates an uncovered steam pipe laid exposed above ground, along a railroad track, to heat a coaling station. This photograph was taken during the winter time and the loss is shown clearly by the melted snow paralelling the line along one side of the track. Fig. 2 shows an uncovered air compressor in the corner formed by the buildings, with the exhaust being wasted to the atmosphere. The view was also taken during the winter. Some sort of shelter should have been provided and the exhaust utilized; there was not much room inside the shop.

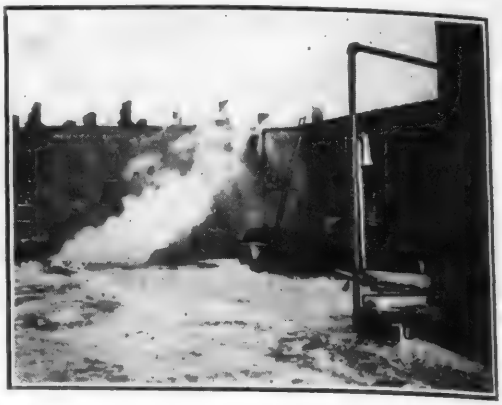


FIG 2—STEAM ESCAPING FROM EXHAUST OF AIR COMPRESSOR.

WHAT THE PUBLIC SHOULD KNOW ABOUT HEATING BOILERS

Points for the Engineer to Pass Along to the Architect and Owner to Secure Economical and Satisfactory Installations.

BY E. C. MOLBY.

Save the fuel that is wasted and there would be no coal shortage. Burn less coal and be warm. When the country saved food its people did not starve, but when they saved coal its people were cold. It is no more necessary to be cold in saving coal than to starve in conserving food. All that is necessary is to get full combustion of the coal used and utilize its heat products to the full.

This result cannot be attained when builders of houses take no interest in the kind of heating plant that is installed in their building or pass over slip-shod workmanship in the building.

A few days ago the writer was told by a boiler salesman that people didn't want to save coal; all they cared for was to have a warm house and most people paid little attention to the quantity of coal burned, leaving the operation of their heating plant to the neighhood fireman who put on coal and left the drafts open. When the coal was gone the owner bought more.

This is waste, not economy.

It is surprising to see how many home builders let the general contractor attend to all the details of their heating plant and by the time they take up the question of heating, the "extras" put over by the builder have absorbed all their available funds so that the heating and plumbing jobs are accepted, because the owners cannot afford to spend any additional money on them.

OPERATING COST DECIDED WHEN CONTRACT IS SIGNED.

When the house builder decides his heating contract, he decides the operating cost of his plant. Economy or waste is the decision. Each heating plant is surrounded at its inception by conditions that are irrevocable and the waste or economy of the plant depends upon those conditions. There-

fore, when a heating plant is installed, the conditions of installation should be controlled and the plant should be installed under those conditions that make for economy.

INADEQUATE HEATING SYSTEMS THE RULE IN SMALL HOUSES.

It is usual to install inadequate heating systems in small houses where the owner is striving to save money to pay for his home. He gets a "competition" boiler, on which the manufacturer publishes a special folder giving higher capacities than in his regular catalogues. Thus, the man who can least afford to pay coal bills is obliged to buy more than his proportion because the small heating job is built on a low manufacturing and installation economy basis for speculative work, without regard to operating expense.

This also applies to larger houses when they are being built by a developing realty company and sold on the installment basis. In most of these cases the purchaser has little opportunity if any to decide the details of his home.

BUILD REASONABLY WELL OR NOT AT ALL.

The first requisite to heating is to have a building so built that it can be heated. It should be reasonably well built and tight, not reasonably as applied to cost, but as applied to practical building. Build reasonably well or not at all. A good dose of weather strips, morter, cement, storm windows, and the stopping of leakages around cornices, gables, and porches would help a great many on the road to economy.

THE CHIMNEY A VITAL FACTOR.

Included in these conditions and of first importance is the chimney. As to chimneys it is apparently the understanding of architects and builders that any connected opening from the boiler to the outside atmosphere is all that is required, and little attention is usually paid to size, height, or interior construction. Most chimneys leak, so that the natural draft of the flue is lost by taking in air from leakages. This results in a dead fire—very slow to come back when it has gone down and one that gives unsatisfactory results.

The down-draft boiler requires no better flue than any boiler ought to have. It would be found that even though the up-draft boiler worked on a flue and perhaps heats the building, if the up-draft boiler had a chimney that was properly built and of sufficient size for proper combustion, there would be no comparison between the results obtained with such a flue and the defective one. The proper chimney is a great power for economy and for heating results and the first requisite of a heating plant is a chimney flue sufficient to properly burn the quantity of fuel per hour that is required to furnish heat to the building. The chimney should be properly planned and then closely superintended to see that it is built in accordance with the plans.

A chimney with too much draft can be controlled by dampers. The poor chimney does not permit of control. The poor chimney will generate enough heat to release the gas from the fuel, but will not furnish oxygen for proper combustion. Hence the plant becomes a gas plant, generating gas and passing it to the chimney unconsumed, entailing the loss of fuel that has cost high per ton. The leaky chimney permits losses by taking in air at various points and not sufficient through the boiler. The chimney should not be choked, but should be straight, and clean. It should extend above the roof to avoid back drafts and be of such height and area to furnish the necessary oxygen for combustion of the fuel.

VALUE AND KIND OF FUEL TO BE BURNED SHOULD BE DETERMINED AT TIME OF INSTALLATION OF PLANT.

To develop the capacity of a boiler the chimney and grate area must be proportioned to the value and kind of coal burned. The poorer the coal the larger the grate and the better the chimney required. The chimney should be designed for the results required

and not because it enhances or detracts from the architectural beauty of the building. A chimney that has the required power for the work in hand is a better looking chimney than an artistic one that fails to perform its work. I sometimes wonder why some architects and builders put chimneys in houses at all.

WHY BOILERS SHOULD BE OF AMPLE CAPACITY.

Next to the chimney comes the boiler which, in combination with the chimney, produces combustion. The boiler should be constructed with right proportions and the manufacturer should endeavor to build the very best boiler that he can build, whether for a small job or a large one.

The boiler should be of ample capacity not only to take care of the condensing surface it supplies, but with a leeway to overcome any local conditions, such as extreme weather, poor firing, poor construction of the building, or poor coal. The object of a heating apparatus is to warm the house comfortably in winter weather.

The heating engineer who estimates the radiation from a plan is unable at that time to take into consideration the details of construction. He assumes that the building is reasonably well built and tight. This may or may not be so when the building is completed. An extra allowance should be made to cover this.

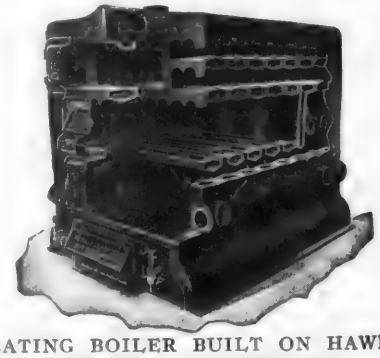
When the building is placed in an extremely exposed condition and gets the effect of the cold winds of winter, there is a condition that the engineer may not have seen or known about at the time he estimated the radiation, but a special allowance should be made in the size of the boiler. He is also unable to know who is going to fire the boiler. It may have good attention or it may have poor attention, but the matter of attention should be allowed for, as every man or every woman is not a fireman and most of them do not care whether they are good firemen or not.

Also allowances should be made for poor coal. During the recent fuel shortage there was shipped out millions of tons of slate and refuse from the mines that were sold to the consumer as coal and any boiler with 50% to 80% of slate and refuse in place of coal cannot perform to its capacity. A great deal of suffering was caused on account of this fuel condition. Allowances for fuel should be made unless the quality of the coal to be used is of a definite quality and its B. T. U. content known.

Then, again, a larger boiler submits to regulation. The instalation of the proper size boiler would mean such an economy that there would be no waste of fuel. The boiler should be installed for its economical features and not because it costs a few dollars more on the first cost. If jobs were installed on this basis it would relieve the fuel shortage of the country, would help the man purchasing the small home to look after his overhead expenses and would be an aid in reducing the operating cost of the home, not only as to fuel but domestic help.

HAWLEY DOWN-DRAFT PRINCIPLE THE CORRECT ONE.

When Hawley patented his down-draft furnace he started an opportunity for economy in combustion for all size plants. His down-draft boiler would burn the various grade of bituminous coal without smoke, and with high efficiency.



HEATING BOILER BUILT ON HAWLEY DOWN-DRAFT PRINCIPLE.

These down-draft boilers are of two kinds: one, the Hawley type, with one grate above the other; and the other, the magazine type, with a hori-

zontal ash-grate and a vertical water-grate. Both apply true principles to their burning. The first is used only for bituminous coal—the second for both anthracite and bituminous. The magazine type has a magazine-feed carrying a greater supply of fuel.

BITUMINOUS COAL A SUBSTITUTE FUEL ONLY.

Bituminous coal, in the mind of the writer, should not be used in low-pressure plants except where they have a fireman for constant attention or in districts where anthracite coal is not available as fuel. Wherever anthracite coal is marketed, that fuel should be used in all heating plants, on account of its better burning qualities, less dirt in handling and firing the fuel and less dust and soot from the chimney.

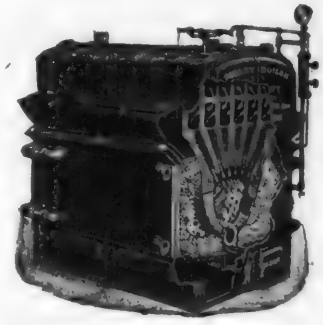
The down-draft principles of combustion has been applied not only to bituminous coal, but also to anthracite, and has met with great success because manufacturers have made a boiler to take advantage of the true principles of combustion, have built a boiler around a principle, and have gained high efficiency thereby. The same principle that produces smokeless combustion with bituminous coal produces gasless combustion with antracite coal by burning the gas, as well as the smoke. With anthracite coal, the boiler can be used with a magazine-feed carrying fire for long hours without attention. This reduces not only the cost of fuel, but also the cost of the labor necessary to operate the plant.

THE MOST ECONOMICAL HEATING PLANT.

A heating system which embodies the down-draft magazine-feed boiler and connects it with a thermostat is the most economical heating plant that can be provided, and represents such a large saving in coal that fuel famine would be unknown if such boilers were adopted for all work.

The manufacturers of this type of boiler had some difficulties the first years of their construction by accepting orders for boilers for any installation without inquiring into the construction to which the boiler was to be set, its chimney or the size boiler to be installed, with the result that a number of boilers were unsatisfactory, entailing a loss not only to the manufacturer, but to the fitter and great annoyance to the owner. All of these have been overcome, as the manufacturers now investigate the conditions of installation so that the success of the apparatus is assured.

During this period only a small percentage of the boilers shipped were unsatisfactory and in every case the trouble could be traced to local conditions. The great majority of these



DOWN-DRAFT PRINCIPLE APPLIED TO MAGAZINE-FEED BOILER.

boilers were very satisfactory and the results obtained convinced the layman and many times the steam fitter that the boiler was going to perform some miracle or had magic influence over the fuel that was to be burned and that any kind of fuel could be burned and good results obtained. This erroneous interpretation of the powers of the boiler created considerable annoyance for the manufacturer, steam-fitter, and the owner. The down-draft boiler is not a miracle worker and does not change the burning qualities of fuel.

When a caking bituminous coal is fired the fireman finds that it cakes and that it performs all the antics that it would perform under ordinary firing conditions in up-draft boilers. Only free-burning bituminous coal should be used in small heating plants with down-draft boilers.

The efficiency of the down-draft boiler construction and the high merits of this type of construction, shown by the results of many hundreds of this type that are being built today, has brought about healthier conditions, more sanitary homes and has relieved many cities of the smoke which formerly was obscuring the city and laying heavy coatings of dust and smoke and soot over the buildings and smothering the life of its people.

ADVANTAGES OF MAGAZINE-FEED TYPE.

The magazine-feed down-draft boiler not only has a big fire-pot, carrying a sufficient fire for its steam reqiirements, but, on account of the magazine-feed, keeps that fire at a normal depth so that the combustion is even. The ashes accumulating on the grate do not shut off the draft as in the up-draft boiler and, on account of its steady draft, the boiler lends itself to automatic control or thermostatic control in that when the drafts are opened automatically or by the thermostat the operator is assured that there is a fire to take care of the demands made upon it. No matter how severe the weather, or how many times the drafts are opened during the night, when morning comes there is a bed of fire in the boiler sufficient to warm the house when the drafts are opened.

The writer has had considerable experience with various types of fuel and various kinds of firemen and a very large variety of chimneys and can say positively that granite or Peekskill gravel or slate is a poor substitue for fuel; that in firing bituminous coal, it requires efficient firing and the proper kind of attention, and attention at a time when the fire is in a condition to require it; otherwise results are lost.

A few years ago the writer met a man who had been burning wood in one of the old wood stoves on a down-draft principle for years. He would put the wood in the stove and then light it at the top, using an up-draft. In this way he claimed to be getting full value of the heat and burned less wood and with less attention and more satisfactory results. This he called a down-draft because the fire burned from the top backwards towards the draft opening.

FIRE WILL BURN TO THE DRAFT.

In any coal boiler the fire will burn up to the draft regardless of where that draft is placed. With bituminous coal the fire will creep upward until it burns up to the draft entrance and will do the same with anthracite coal, so that it is necessary to have tight fitting magazines and a well-cemented boiler.

No matter what architectural beauty his building may have or how many priceless tapestries and rugs or valuable ornaments or labor-saving details, if its heating is not successful, the building is a failure. No building, and especially a home, can be satisfactory without proper heating and in placing the heating apparatus in any building it should be of ample size to take care of the work easily.

SMALL APPARATUS CANNOT BE REGULATED.

An apparatus that is too small cannot be regulated, and regulation is necessary for economy. The owner who builds a residence costing $10,000 to $50,000 and leaves the details of his heating system or his plumbing to the general contractor is making a great mistake. The cutting off of a few dollars in heating means success or failure to his home.

INFLUENCE OF VARIOUS TYPES OF HEATING SYSTEMS ON QUANTITY OF FUEL BURNED.

The various types of heating systems have their influence on the quantity of fuel burned. Some types permit of such regulation that the building is kept at an even temperature and a building evenly heated requires less coal than one in which the temperature is up and down. The type of system to be selected is the one that is best suited to the requirements of the building. Some buildings must be ventilated, some heated only to 50° or 60°, while others require tem-

peratures of 70° for twenty-four hours, some only nine to ten hours. These variable requirements can be met by the use of different heating systems.

REGULATION NECESSARY IN A HEATING PLANT.

The apparatus that is too small cannot be regulated therefore the boiler should be of ample size. Radiation that is too small for the work cannot make for efficiency. A poorly-constructed and leaky chimney cannot produce economical results. Poor installation and bad piping or an improper system cannot aid in economy. Regulation is the one thing that is necessary to a heating plant to produce economical results and an apparatus that is too small is not subject to regulation while a poor chimney cannot be regulated.

The dampers of a boiler should be a draft door, the check-draft of the smoke pipe and a hand damper in the smoke pipe. The hand door and the check-damper should be connected to the damper regulator and the hand damper used as a control of the chimney draft. It can be set to that point which is found by experience to be required for that particular building. No manufacturer can lay down a rule as to where this damper should be set. It must be set to fit each particular job under its peculiar local conditions.

CHIEF CAUSES OF WASTE OF FUEL.

Waste of fuel comes from improperly-covered boilers or piping in the cellar, dirty flues or dirty fires. Heat is wasted that goes up the chimney on account of the boiler being too small for proper regulation or because the chimney is too poor for proper combustion. Leaving the fire door of the heater open will also waste fuel, as it pulls the gases off the top of the fire, and carries them away up the chimney. Other wasteful practices are carrying a low fire through which the draft passes freely and burns rapidly without at any time having a sufficient bed of fire to perform the duties that are required of it; or letting the ashpit become full of ashes, (burning out the grates); or shaking unburned and live coal through the grates and throwing it away in the ash. No matter what kind of a grate bar is placed in the boiler, if you shake it long enough you will shake coal through it and care should be taken by the fireman to see when the fire is clean enough to stop shaking.

The saving of fuel is a duty every man owes his country and his neighbor and in building or installing a heating plant he should be sure that he has

a well-constructed building,
a good chimney,
sufficient radiation,
a properly-installed piping system and
the best regulation he can buy with this installation.

The right kind of attention will produce results of economy, comfort and satisfaction, of which he would be justly proud, while the reduction of maintenance cost in coal and labor would make his property more valuable and help in solving the domestic labor problem.

CHIMNEYS AND CHIMNEY DRAFT

Common Troubles Illustrating the Importance of a Properly-Constructed Smoke Flue.

BY WILLIAM T. HARMS.

EDITOR'S NOTE.—*At a recent meeting of the Michigan Chapter, A. S. H. & V. E., a paper was read with the above title which evoked considerable discussion on the part of those present. In the following article Mr. Harms presents a few of the points that were brought out in this discussion.*

Generally it is quite rare to find a chimney giving trouble where the job is of such a character as to justify the employment of an engineer in the designing and superintending of the same. However, the heating contractor who caters to the smaller class of buildings is frequently brought face to face with draft troubles, in many cases where he least expects them.

The local building codes are quite adequate, in most cases, provided the various conditions are carefully carried out, for no matter how good the intention of the code, this is utterly defeated if the workmanship is of a careless or slovenly nature. For instance, most codes call for a vitrified tile lining to be bricked in as the chimney is laid up. The usual way, however, in which this is carried out is as follows: The brick work is run up about 5 ft. from the floor of the basement before the tile is started. After this has been bricked in, no tile is put in until the brick work has gone up about 2 ft. above the first tile. The idea seems to be to trust to luck that it may be tight, for some mortar may have landed on the previously-inserted tile. The owner is usually satisfied because he believes the code has been complied with, for his chimney is lined.

GOOD DRAFT MAKES IT POSSIBLE TO BURN SMALL SIZES OF COAL.

There are many brick masons who assume than any hole in a brick wall constitutes a chimney. They do not realize the importance of a tight flue, straight and of ample area. Yet there is scarcely anything so important in a building, for the attainment of economical operation of a heating plant, as a correctly-designed and constructed chimney.

The importance of this statement can be readily understood when it is realized that with good draft it is entirely possible to burn small sizes of either anthracite or bituminous coal satisfactorily which, of course, means a corresponding saving in cost over the large sizes. Without a strong draft these small coals cannot be burned without great loss, due largely to imperfect combustion and also because it is necessary to burn a portion of the coal for the express purpose of heating up the chimney and thus augment the draft. This, of course, re-

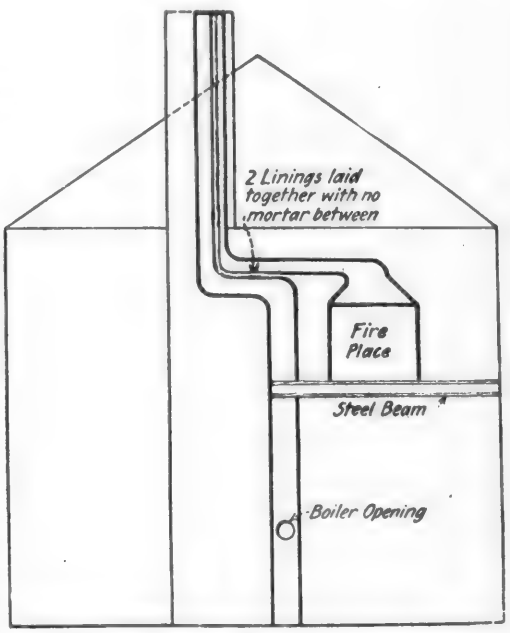


FIG. 1—EXAMPLES OF FLUES BUILT WITHOUT BRICK DIVISIONS.

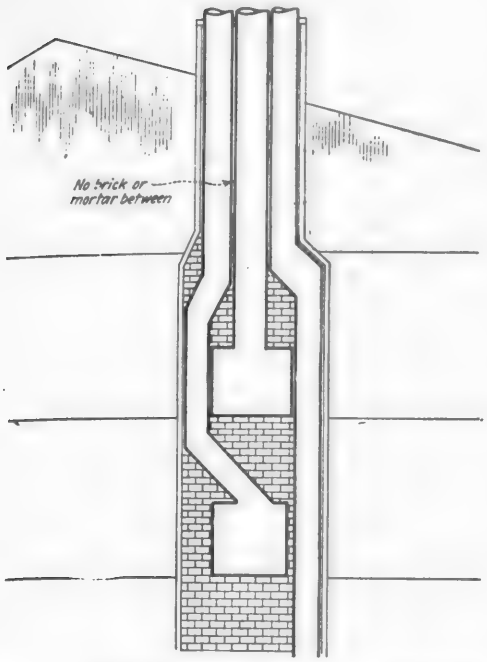


FIG. 2—ANOTHER EXAMPLE OF IMPROPER FLUE CONSTRUCTION.

presents a complete loss, as far as heating the house is concerned. Excessive draft is not encountered very often and when it is, it can readily be controlled by dampers. Poor draft usually cannot be remedied very readily as it is usually due to some faulty construction.

CONNECTING GAS HEATERS TO BOILER FLUE.

Another source of serious trouble is caused when it is insisted upon that the so-called instantaneous gas heater must be connected to the chimney when it happens, as it generally does, that the same flue must also carry off the products of combustion from the house-heating boiler. The gas heater is usually provided with a pipe 6 or 7 in. in diameter which is always wide open and continuously cooling the flue when the gas heater is not operating, and satisfying the chimney draft through openings having an area of from 28 to 38 sq. in.

It can be readily appreciated what this means.

RUNNING FLUE LININGS IN CHIMNEYS WITHOUT BRICK DIVISIONS.

A further source of poor draft is often encountered where two or more flue linings are run up in one chimney without any brick division between them, as in Figs. 1 and 2; also where the ash dump from open fire places communicate with a chamber which does double duty of ash receptacle and boiler flue.

These, of course, are only a few of the many cases of draft troubles with which the heating contractor has to contend. The unfortunate feature of the situation is that he is usually called upon to guarantee the performance of the apparatus installed and many times he is obliged to prove that some other artisan is to blame when he fails to meet the performance specified because of lack of draft. Therefore, it behooves the careful heating contractor to be on his job when the chimney is being built or, at least, to carefully examine the construction and, if possible, to take readings with a draft gauge, as this will, in many cases, avoid disagreeable consequences.

United States Fuel Administration About to Issue its Report.

Word has been received that the report of the activities of the United States Fuel Administration, in connection with its efforts to improve operating conditions in steam power plants, is in type and will be issued shortly. It was hoped that the report would be available for presentation in this Fuel Conservation Number, as it is known that the Fuel Administration's engineering division had found innumerable instance of steam waste which were being corrected at the time the Fuel Administration ceased to function. Due to the failure of Congress to make any provision for continuing the work, the conservation program had to be abandoned, but the report of what was accomplished will nevertheless offer many suggestions to designers and users of steam apparatus.

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IF THE winter of 1917-1918, with its scarcity of coal and other hardships, can be called a period of unprecedented anxiety and stress, what, we wonder, will be the verdict on the approaching winter? As this Fourth Fuel Conservation Number goes to press, ominous reports are coming in of the imminent shortage of coal. Equally ominous are the threats of the railroad workers to tie up the railways of the country unless their wage demands are met, and this in spite of the fact that the railways are already facing the responsibility for a possible coal shortage, the claim being made that the "order early" campaign is a success in every respect except that there are not sufficient cars available to move the coal. As if this were not enough, Europe is facing an even more serious coal famine, with England far behind in its production and Italy already in distress. It seems certain that a larger amount of coal than ever will have to be exported to meet Europe's needs.

But the crisis facing the American people will be met and met successfully. Let there be no mistake about that. The time has gone by when the need of national unity made it necessary for the people to tolerate such unbridled industrial agitation and conscienceless profiteering with which the country is now cursed. A day of reckoning is surely coming and it will be a perfectly orderly one, too, in which the situation will be adjusted by the process of law. The activities of the Department of Justice in its war on the high cost of living are already bearing fruit. The Department has not come to the coal situation as yet, but when it does, we have the utmost confidence that, spurred on and supported by the American public, there will be a readjustment of affairs that will result in a sufficient supply of coal and at reasonable prices.

But what a text is furnished by the present situation for a discussion of Fuel Conservation. He who runs may now read the signs of the times. For years experts have been telling us that anthracite must go—in 99 years. That time seems a long way off, but the rise in price of anthracite to a prohibitive figure is not so far away and this is the jolt that is making the country sit up and take notice. To be sure, the immediate difficulty can be traced directly to the war and applies to bituminous, as well as to anthracite. But in the years to come, even of the present generation, we may expect to see the use of anthracite reserved for the few who are able and willing to pay for it.

In the meantime, Fuel Conservation is the watchword of the hour and power and heating engineers are bound not only to take a leading part in promoting better and more economical practices in their field, but in influencing their clients to adopt approved fuel-saving apparatus and devices.

This Fuel Conservation Number is offered to the trade as a contribution towards that end.

BETWEEN-SEASON GAS HEATING

Performance Records of Apparatus that May Be Used with Advantage During the Early Winter and Spring.

Editor's Note.—*It has been conclusively demonstrated that a large portion of the waste of fuel in house-heating systems occurs during the milder portions of the heating season, when the boilers are not operating at their highest efficiency and when overheating is the rule. For this reason the intermittent use of gas and even of electric heat offers possibilities in fuel economy. The accompanying report contains important data on the use of gas as a heating medium.*

Probably as accurate data as any yet published on the heating of houses by gas are those reported by the Consolidated Gas & Electric Light Company, of Baltimore. In a series of tests conducted by the company's Industrial Fuel Department and carried out under the direction of Thomas King, superintendent of the company, by E. D. Milener, assisted by C. C. S. Walter, two houses were rented and used for experimental purposes. The tests were made with the special idea of establishing the cost of heating various types of houses with different gas heating systems, and the merits and limitations of the systems commonly in use, so that the probable cost of heating any house with gas could be estimated and the most efficient and convenient heating system recommended.

Tables 1 and 2 give in compact form the results of the tests, so far as the cost of operation of the various systems is concerned. Table 1 gives direct results of the tests. In Table 2, the costs for water heating and warm-air heating systems are included, being based on deductions from the test results, checked by experience in other installations.

TEST NO. I, USING UNVENTED GAS-FIRED STEAM RADIATORS.

In the first tests the house was heated by unvented gas-fired steam radiators, which are especially recommended for small stores and for certain rooms and hallways in residences, but not for bedrooms. The house chosen was three stories high, of brick, in a row facing the east. It had eight rooms, with reception hall, bath and hall room on the second floor. There is a bay window in the second-floor front room. The bathroom is constructed of wood and entirely overhangs the yard. The general dimensions of the house are: Length, 60 ft.; width, 17 ft.; ceiling height on first floor, 10 ft, 2 in.; on second and third floors 9 ft. A cellar extends the whole length of the house. The doors and windows are not weather-stripped and are rather loose fitting.

The total amount of steam radiation required was figured at 342 sq. ft., the Mills formula being used. The accompanying floor plans show the locations of the various radiators. The instruments were a gas meter, a recording demand indicator, and

TABLE 1—ESTIMATED GAS CONSUMPTION FOR BALTIMORE RESIDENCES FOR THE HEATING SEASON, OCTOBER 15 TO APRIL 15.

Direct Estimates from Tests.

Type of Installation	Consumption of Gas Per Sq. Ft. Radiation	Per Cubic Foot Contents		Cost per Heating Season, with Gas at 35c. per 1000 cu. ft. Per Sq. Ft. Radiation.
		Inside	Outside	
Gas Steam Radiators Unvented	617	11.0	10.2	$0216
Gas Steam Radiators, Vented Radiators in Bedrooms	711	12.7	11.5	0.249
Converted Coal-Designed Steam Boiler	995	18.4	14.5	0.348
Gas-Designed Steam Boiler.....	935	17.3	13.6	0.309

In the foregoing table the radiation is figured by the Mills formula in each case: Steam radiation in square feet equals one-half exposed glass, plus 1/20 exposed brick wall, plus 1/200 cubical contents to be heated.

1 sq. ft. of water radiation is considered as equivalent to 6 sq. ft. of steam radiation.

The figures for consumption per cubic foot of contents apply only to brick or stone houses with two exposed sides.

The figures for cubical contents do not include basements.

TABLE 2.—ESTIMATED GAS CONSUMPTION FOR BALTIMORE RESIDENCES FOR THE HEATING SEASON, OCTOBER 15 to APRIL 15.

ESTIMATES FROM TESTS AND DEDUCTIONS APPLIED TO GAS-HEATING SYSTEMS.

Type of Installation	Consumption of Gas Per Sq. Ft. Radiation.	Per Cubic Foot Contents Inside	Outside	Cost per Heating Season, with Gas at 35c. per 1000 cu. ft. Per Sq. Ft. Radiation.
Gas Steam Radiators, Unvented	600	11.0	10.0	$0.21
Gas Steam Radiators, Vented Radiators in Bed-rooms	700	12.8	11.5	0.245
Converted Coal-Designed Steam Boiler	995	18.4	14.5	0.348
Converted Coal-Designed Water Boiler	525	18.2	12.8	0.184
Coal-Designed Steam Boiler	860	15.9	11.3	0.299
Coal-Designed Water Boiler	500	14.0	9.9	0.158
Gas-Designed Warm-Air System		15.0	10.6	

The figures for consumption per cubic foot of contents apply only to brick or stone houses, with two exposed sides. Otherwise the table is based on the same data as Table 1.

recording and non-recording thermometers. The latter were placed at various points throughout the house to note any unusual conditions.

The tests were run in the middle of the winter season, from January 31 to March 3. During this period conditions were kept as nearly as possible the same as those that would exist in an average house of this type when occupied. During the day the temperature was kept at 70° F, and at night around 60°. The radiators were lighted in the morning and were constantly adjusted as the weather changed outside. The house was ventilated from time to time. Hourly readings were taken day and night of the temperature on each floor of the house, the outside temperature, the condition of the weather, the velocity and direction of the wind and the hourly consumption of gas.

Sheets were made up daily, showing all onditions as they existed from hour to hour. The difference between the average of the inside temperature and the outside temperature was shown for each 24 hours and from this was calculated the amount of gas used per degree difference per day. This amount varied, for different days, from 30.6 cu. ft. to 62.9 cu. ft. the average for the length of the test being 45.1 cu. ft.

A summary sheet for the total period of the test was compiled, containing the daily averages of all observations, as well as the averages and totals for the period of the test.

It was assumed that the average dwelling, to be properly heated, should be held at 70° F. for fifteen hours of the day, and at 60° for the other nine hours. This is equivalent to holding a temperature of 66° day and night.

The mean temperature for Baltimore from October 15 to April 15 is 40° F. Therefore, to properly heat a house in that locality, it is necessary to constantly maintain a difference of 66° and 40°, or 26° F.

From the summary sheet we get the gas required to heat the house per degree difference per day as 45.1 cu. ft. 45.1 cu. ft. $\times$ 26 = 1172.6 cu. ft. per day required to heat the house. Considering the heating season as 180 days, 1172.6 $\times$ 180 = 211,068 cu. ft. of

ECONOMIC GAS-FIRED STEAM RADIATOR.

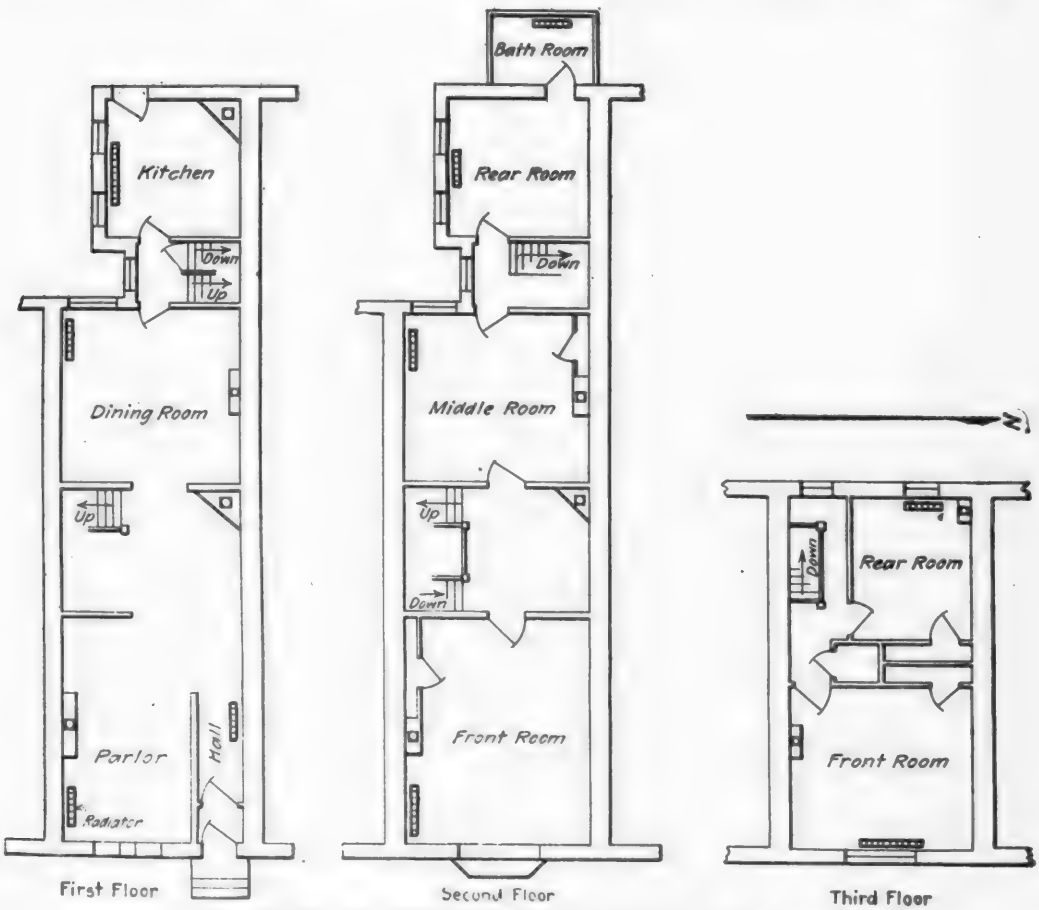
gas per season. The house contains 342 sq. ft. of radiation. 211,068 ÷ 342 = 617 cu. ft. of gas per square foot of radiation per hour.

The cubical contents of the house, using the inside dimensions and not counting the cellar, which is unheated, is 19,150 cu. ft. Therefore, we have a consumption of 211,068 ÷ 19150 = 11 cu. ft. of gas per cubic foot of contents per season.

Supplementary tests were run at different times to determine the degree of vitiation of air in the rooms. In one room 13 ft. 6 in. x 18 ft. x 9 ft. 2 in., which was kept closed, an 8-section Economic gas-steam radiator was left burning for four hours. During that time the CO_2 rose from 0.3% to 1.6%. Another test was run to determine the air vitiation under ordinary ventilating conditions. Readings were taken at four different points in the house after the radiators had been burning for four hours and were maintaining a constant temperature throughout the house. The CO_2 remained constant at 0.3%, the room temperature also remaining constant to 69°-70° F.

TEST NO. 2, USING CONVERTED COAL-FIRED STEAM BOILER.

In the second test a converted coal-fired steam boiler was used in a typical two-story, brick, block house having a central steam or water heating plant. Commencing on the use of such a heater, the report states that its only advantage is the low first cost. It is at best a makeshift and in the long run an expensive one. Each furnace to be converted represents its peculiar and individual problem. Reasonable efficiency can only be obtained by careful selections of burners, with skilled adjustments of air and draft conditions, and these conditions are not likely to be maintained in the ordinary residence. The coal furnace has too little heating surface to properly take up the heat from the gas and usually its firebox is not of a shape to lend itself to the satisfactory burning of the requisite amount of gas at low pressure. Conversion, it is added, should only be resorted to where it is not possible to induce the owner to install a gas-



PLANS OF HOUSE USED IN TESTS 1 AND 3.

designed furnace. Where conversion is carried out and where a coil has been placed in the furnace to furnish hot water for domestic purposes, it will be found more satisfactory and efficient to remove it and heat the water in a separate gas heater, as it usually interferes with the proper application of the burners to the furnace and gives sometimes too much and sometimes too little hot water.

Of the various systems, hot water will be found most efficient and convenient, its only disadvantage being its greater cost, the large space occupied by the radiators and the length of time it takes to respond to gas being turned on and off. Next in order of efficiency will be found hot air, vapor and steam, it being considered in each case and the system is well-designed and properly installed.

Some form of thermostatic control should always be insisted on, in connection with a gas furnace, both for the convenience of the owner, and to keep down the cost.

The house used in the second test is ordinarily heated by steam, the installation including nine radiators, supplied through a single-pipe steam line and wet return. The parlor, reception hall and upstairs hall are not divided by doors, so that heat generated down-stairs readily ascends. The doors and windows are not weather-stripped, but are fairly tight.

The furnace in which the burner was installed has a 20-in. fire-pot. The test was first run with a refractory burner of the Improved Appliance Company make, installed in the boiler. The burner was composed of

TYPE OF REFRACTORY BURNER USED IN TEST NO. 2.

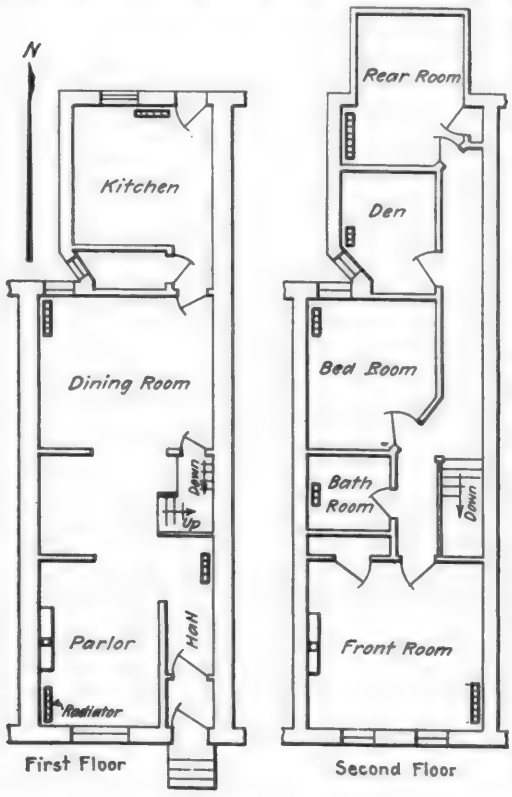
a gas cock orifice, adjustable air mixer, mixing tube, and circular body 10 in. in diameter and 6 in. high. The body is made of two hollow fire-brick parts, with gas ports extending all around the sides. Combustion takes place between these two parts and the flame extends from the ports to the wall of the furnace.

The grate was removed and the burner placed so that the ports were 2 in. above the grate level. An arch of fire-brick supported on iron racks was built 8 in. above the burner, to prevent a direct passage of burned gases through the center of the fire-pot, until the top was reached. Fire-brick was placed in the smoke ducts and every effort was made to keep the passage of burned gases as slow as was consistent with proper combustion.

Another type of burner was also installed for a few days. This was a cast-iron burner, with a two-cock control. The ports are vertically drilled, the burner being similar to that used in the Kane gas-fired steam boiler. The flow of the gas to the burner was controlled by a 3/4-in. magnet valve.

The total amount of radiation in the house is 205 sq. ft. The radiators were located at the points shown in the floor plans, there being four radiators on the first floor and five on the second floor. The steam risers passing through the first floor to the second-floor radiators, are all exposed.

A furnace water-heater was placed in the fire-box of the furnace and furnished sufficient hot water for the house when the furnace was burning steadily. However, in



PLAN OF HOUSE USED IN TESTS 2 AND 4.

moderate weather, when the furnace was cut out most of the time, it was necessary to resort to a gas water-heater to supplement the supply of hot water from the furnace.

The test was began February 11 and continued until March 9. As in the previous test, conditions were kept as nearly as possible the same as those that would exist in an average house of this type when occupied. The burner was automatically turned on at 7:00 a. m. and was turned off at about 10:00 p. m. each night.

The same hourly readings were taken as in the first test. During the test, the burner was either on full or entirely cut off.

The best results were obtained with the refractory burner adjusted to burn 225 cu. ft. of gas per hour.

The amount of gas used per degree of difference per day varied from 24.9 cu. ft. to 64 cu. ft., the average for the length of the test being 43.6 cu. ft. From a summary sheet, compiled as in the first test, it was found that the gas required to heat the house per degree difference per day was 43.6 cu. ft. Using the same method of calculating as in Test No. 1, we have a consumption of 14.5 cu. ft. of gas per cubic foot of contents per season.

Supplementary tests were made to find the amount of heat lost up the flue. With no baffles at all in the uncovered furnace, the flue temperature ran up to 540° F. After baffles had been placed in the flue and the furnace covered, the flue temperature fell to 270° F. Under the latter conditions, only 5.5% of the heat generated was lost up the flue.

TEST NO. 3, USING VENTED GAS-FIRED RADIATORS.

In this test the Economic radiators in the sleeping rooms were replaced by five Hawks radiators. This type, it is stated, eliminates the danger from air vitiation, but at a considerable sacrifice of efficiency. It is also expensive and sometimes difficult to install suitable and not unsightly vents. In the Hawks radiator a bar burner runs through the center of the radiator, near the bottom, the heat from which circulates through the various coils and sections of the radiator. Small slots are cut in the radiator near the floor and air for combustion is taken in from the room through these slots. Connection is made to the chimney through a 2-in. iron pipe. The sections do not become any hotter than a steam radiator.

This test was begun March 5 and continued until April 1. It was run along the same line as Test No. 1, the house being ventilated from time to time. Using the same method of figuring, with the house containing 342 sq. ft. of radiation, it was found that 711 cu. ft. of gas was used per square foot of steam radiation per heating season, 12.7 cu. ft. per cubic foot of inside contents and 11.8 cu. ft. per cubic foot of gross contents per season.

The amount of heat lost up the flue with the Hawks radiators was 9.6% and 543% excess air. There was no perceptible vitiation of the air.

TEST NO. 4, USING KANE GAS-FIRED STEAM BOILER.

The house used in this test was the same as that mentioned in Test No. 2. In this case the house was heated with steam radiators supplied with steam from a 5 H. P. Kane gas-fired boiler, connected to the steam system as a by-pass to the coal-fired boiler. The Kane boiler is of the vertical tubular type and is composed of a steel shell with a number of 1-in. tubes. An asbestos-lined steel casing encircles the boiler, leaving an air space between. A cast-iron cored burner, with two separate cocks, generates the necessary heat. This burner is fitted and drilled. A pilot from an automatic water heater was installed and kept burning all the time. The flow of gas was controlled by a snap-action, lever handle, sylphon valve. This cut the gas off or on instantly. A rubber diaphragm connected to the boiler actuated a lever which closed the gas valve as the steam pressure increased and opened the valve as the pressure decreased. The action of the level-handle gas valve was also controlled by a Minneapolis heat regulator. A back-draft vent was placed in the flue connection to the chimney.

A total of 205 sq. ft. of radiation was supplied by the boiler. The test was begun March 10 and continued until April 1. The house was ventilated from time to time and all other conditions of Test No. 2 were followed. During the test the burner was either on full or entirely cut off. For a steam plant this gives the maximum efficiency.

Mechanically the system was satisfactory, except the working of the diaphragm. With this type of boiler, the diaphragm is from 2 to 3 ft. below the water level, so that this head of water acts on the diaphragm in addition to the steam pressure. Consequently it was impossible to adjust the diaphragm lever to act under less than a 3-lb. variation of pressure. This was found to be undesirable and, on this type of boiler, the report recommended the placing of the diaphragm above the water level.

The amount of gas burned varied for different days from 23.4 cu. ft. to 61.3 cu. ft.,

the average being 40.9 cu. ft. Using again the same method of calculation as in the other tests it was found that 1063.4 cu. ft. of gas was required to heat the house each day of the heating seaon. Considering the heating season at 180 days, this came to 191,412 cu. ft. for the entire season, 933.7 cu. ft. per square foot of steam radiation per season, 17.3 cu. ft. per cubic foot of interior contents and 13.6 cu. ft. per cubic foot of gross contents.

After the burner had been properly adjusted the heat lost up the chimney was 6.1% and the excess air, 222%.

THE RECTOR SYSTEM.

In addition to the four tests here reported, observations were made and data obtained from a number of residences using the Rector system of gas heating. These showed a satisfactory low gas consumption per square foot of steam radiation of the thirteen installations considered, the average being 594 cu. ft., which is almost exactly the same figure arrived at for unvented gas steam radiators. The most serious faults of the system reported were the high temperatures reached by certain parts of the radiators.

COMPARISON WITH COAL HOUSE-HEATING.

The report also gives figures on the coal consumption of typical Baltimore residences having different types of heating systems. These figures were gathered from a large enough number of houses to be considered absolute averages. They indicate that the consumption of coal per cubic foot contents of brick houses in a block with two exposed sides is about 0.78 lbs. per heating season. This figure, with coal at $8.00 per ton, shows a cost of 0.00267 per cubic foot of contents per heating season.

The corresponding figures for gas for houses of the same type are: Consumption, 10.6 cu. ft.. and cost, at 35 cents per thousand, $0.00371 per cubic foot of contents per heating season.

These results show that due to the greater efficiency of application obtainable with gas, the B. T. U. necessary per cubic foot of contents is 6300 against 9000 with coal, again in efficiency of about 30%. But with $8.00 coal and 35 cents gas, the cost of fuel is 40% higher with gas than with coal.

The report emphasizes the advantage of using gas to heat the whole house in the Spring and Fall when, on account of its ease of control, its cost cost can compare favorably with coal.

Current Heating and Ventilating Literature.

Under this heading is published each month an index to the important articles on the subject of heating and ventilation that have appeared in the columns of our contemporaries. Copies of any of the journals containing the articles mentioned may be obtained from THE HEATING AND VENTILATING MAGAZINE *on receipt of the stated price.*

ENGINE HOUSES

The Heating and Ventilation of Engine Houses, T. W. Reynolds. Ry. Age, vol. 66, no. 21, May 23, 1919, pp. 1235-1248, 3 figs. Discusses use of underground concrete air ducts as applied to a 30-stall engine house, having concrete floors, brick walls and timber frame and roof. $1.00.

RADIATORS, FLOW OF WATER TO

Care of Heating and Ventilating Equipment, Harold L. Alt. Power, vol. 49, no. 24, June 17, 1919, pp. 923-933. Discusses various methods of controlling flow of water to radiators. 20c.

WORKSHOPS

The Heating and Ventilation of Workshops—I. Engineer, vol. 127, no. 3308, May 23, 1919, pp. 504-506. 8 figs. System in plant having reinforced-concrete roof. 50c.

Organization of the Anti-Corrosion Engineering Company.

An important engineering organization has been formed in New York to take up, on a large scale, methods for the prevention of corrosion in steam, water and other piping. The processes controlled by the company will include that devised by Frank N. Speller, metallurgist for the National Tube Company, for deoxidizing water. The president of the company is Dr. Charles V. Paterno; vice-president and consulting engineer and metallurgist, F. N. Speller; consulting chemical engineer, Dr. Walker; consulting mechanical engineer, J. F. Musselman; executive consulting engineer, Perry West. Mr. West who is well-known among heating engineers, as vice-chairman of the heating engineers' Research Bureau and as president of the society's New York Chapter, resigned recently as supervisor of mechanical equipment for the Newark, N. J. Board of Education after 10 years' service, to take up this new line of work. The company has opened offices at 32 East 48th Street, New York.

Wanted—Draftsman familiar with plumbing, heating and ventilating and general plant piping. Address the Herbold Co., 310 Vicary Building, Canton, O.

USE OF FUEL OIL FOR HOUSE-HEATING BOILERS

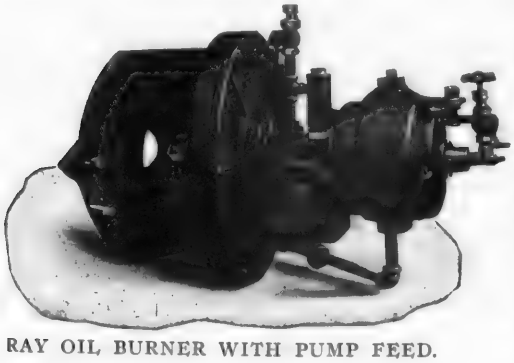
Inquiries received now and then indicate that heating engineers are occasionally called upon to install boilers arranged to burn fuel oil. While the war was in progress it was very difficult in most localities to secure a sufficient supply of fuel oil, but now this method of heating may be expected to undergo a renewed development. On the Pacific Coast a large demand has been created for fuel oil, due to the plentiful natural supply, and for this reason we may well look in that direction for the most authentic data on the subject.

A great deal of time and money have admittedly been wasted on inferior contrivances for burning fuel oil. This has brought out the fact that simplicity is the most essential requirement of an oil burner; it should require no adjustments after installation and should operate over long periods of time without attention.

It may not be generally known that the burning of oil carries a very low fire hazard when a successful burner is used and properly installed. As to the initial cost and expense of upkeep, these have been brought down to a reasonable figure through the simplification, as far as possible, of the necessary machinery, such as driving pumps, air blowers and similar apparatus.

ATOMIZATION OF OIL A PRIME REQUISITE.

One of the prime requisites in burning fuel oil is that the oil must be broken up or atomized and mixed with the air. Each atom of oil must be surrounded with sufficient air to insure immediate and complete combustion while in suspension, when projected within the combustion chamber or firebox. Otherwise there will be carbon deposits, indicating improper combustion and waste.



RAY OIL BURNER WITH PUMP FEED.

In industrial plants steam is available for atomizing the oil. Steam and air atomization, however, while successful, is not altogether satisfactory, chiefly on account of the waste of oil. Steam atomization is only feasible in high-pressure work.

REQUIREMENTS FOR LOW-PRESSURE HEATING.

When it comes to a heating system, the most satisfactory equipment to be efficient must be of a design that will insure the thorough atomization of the low-grade fuels at their natural or atmospheric temperature. The equipment supplying the burner must be of simple design so as to insure the absence of undue friction, long life and low power consumption.

THE RAY SYSTEM

One method which is being used successfully in the Far West provides for atomizing the oil in an open cup, lying horizontally, driven at 3450 R. P. M. and then forcing sufficient air at high velocity around the cup and in a direction away from the cup. In this method, which was designed by W. R. Ray, of San Francisco, and marketed by the W. S. Ray Mfg. Co., of that city, not only is sufficient air introduced for proper combustion, but also enough to direct the fire in the fire-box. Naturally the air leaving the blower would be turning in the same direction as the atomizer, causing the fire to be unsteady and having a tendency to throw oil on all sides of the fire-box. This tendency was overcome by inserting guide vanes in a nozzle surrounding the atomizer, which directs the air from a revolving motion to a straight path. The combustion of the oil is found to be perfect with this method and a machine has now been developed, known as the Ray oil burner, to operate in this manner.

The equipment used with the Ray burner includes a Westinghouse totally-closed motor, which has no running contacts of any kind on the starting or running winding. The hollow shaft of this motor is extended to permit the worm gear to be fastened to the center and the blower and atomizer at the opposite end of the motor. This permits the centering of the bearing on the shaft.

A Hess-Bright ball-bearing is used at each side of the worm gear. This worm gear is encased in a housing which is constructed with an oil well at the base. This

gives the two bearings a splash-feed which is positive and removes the danger of under or over-oiling. This is described as the only type of machine driven by totally-enclosed motor that has but one bearing number and but one place to oil. It is the only burner which uses the oil for cooling the motor, at the same time heating the oil.

With the exception of domestic stoves, fuel oil as low as 14 gravity can be burned successfully, it is stated, without smoke, soot or dirt in all types of fire-boxes where high heat is needed.

RELATIVE COST OF HEATING WITH COAL AND FUEL OIL.

In comparing the relative cost of heating with coal and fuel oil it has been found that on the Pacific Coast, this will amount to about 50% in favor of fuel oil. This percentage is based on coal at $8.00 per ton and fuel oil at $1.50 per barrel of 42 gal., the heat content of the coal being estimated at 14,000 B. T. U. and that of fuel oil at 18,500 B. T. U. per pound, and assuming that the coal is perfectly fired. This does not take into consideration the cost of firing coal, which is an additional item, as additional attendants have to be constantly on the job for four hours per day, whereas with an oil burner one man can supervise a large number of oil burners. This, in some instances, makes a great difference in the cost of operation.

THE FESS SYSTEM.

Another successful method of burning fuel oil is that used in the Fess system. Under ordinary heating boilers rotary burners are used, while the Fess turbine boiler is adapted to long, narrow boilers and those carrying heavier loads than the ordinary heating boiler.

The Fess turbine burner is designed with the express purpose of avoiding excessive pressure, friction, wear and power consumption, and, at the same time, of accomplishing a complete atomization of the fuel oil. The illustration shows the atomizing cup with its turbine blades and the oil tube through which the fuel oil is applied to the inside of the cup. This turbine cup subjects the fuel oil to a high centrifugal velocity in the absence of high pressure. It is carried on two annular ball-bearings, each of which is designed to carry a load of 250 lbs. It has ample provision for lubrication.

The air is supplied to this nozzle at from 6 to 8 oz. pressure, from a direct-connected motor-driven fan of a free-runner type. By the velocity of this air passing through the turbine blades, the atomizing cup is rotated at a speed of from 5,000 to 6,000 R. P. M. The air, after passing the turbine blades further assists in breaking up the oil by its projecting force, and carries it within the combustion chamber where it readily ignites, as combustion starts directly at the tip of the burner. It immediately spreads out, developing a uniform heat throughout the firebox, consuming all the fuel without impinging on the rear wall of the firebox or heating surface of the boiler and, it is stated, entirely eliminating carbon deposits.

The installation provides that the air and oil are set remote from the boilers. Either burner may be operated independently of the other. The burner in the steam boiler is equipped with an automatic regulating valve actuated by the steam pressure on the boiler and so adjusted as to maintain the desired steam pressure automatically.

Industrial Training as a Factor in Reducing High Cost of Living.

American factories are to-day using 6,000,000 workers to do what 4,500,000 men could do as well if they were fairly trained, is the argument which Colonel Arthur Woods, assistant to the Secretary of War, is using to urge the 20,000 factory owners and industrial corporations throughout the country to undertake industrial training for their workers at the same time that they pay them a sufficient living wage during the period of their apprenticeship. With the cost of living soaring daily higher, the question of efficiency in production and manufacture has come to the front as the issue of most fundamental importance. In the manufacturing section of New England alone experts state that the factories are not more than 60% efficient in output, due to lack of sufficient skilled and intelligent man power.

Information on any of the various points connected with installing a system of industrial training for any given industry may be had by addressing Colonel Woods at his New York office, 360 Madison Avenue.

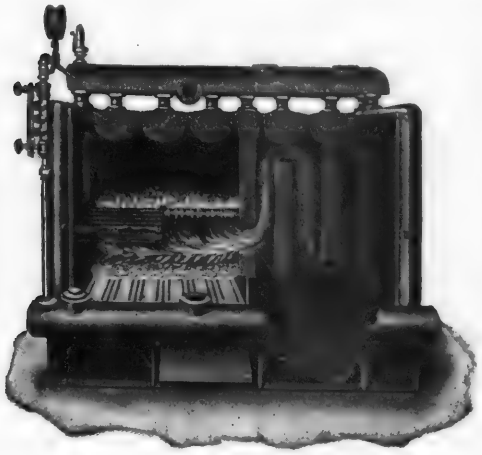
SUCCESSFUL TYPES OF SMOKELESS BOILERS

1—GURNEY DOWN-DRAFT BOILER.

A smoke-consuming boiler that embodies all the desirable features of the Gurney water-tube construction is known as the Gurney down-draft smoke-consuming boiler and is manufactured by the Gurney Heater Mfg. Co., Boston, Mass. In this boiler the upper grates are hollow and filled with water which, with the tubes immediately below them, are entirely surrounded by fire. The large amount of prime fire surface constituting the balance of the heating surface is all exposed to the direct action of the fire.

These boilers are of the header type, giving large steam reserve space. The headers are connected to the sections by 3-in. nipples, with heavy lock nuts. In all other respects the boilers are identical with the Gurney Bright Idea construction which has long enjoyed an enviable reputation in the trade for its steady water-line, its efficiency in operation, economy in fuel consumption and durability.

Two exclusive Gurney features which are characteristic of this boiler are (1) the openings between the sections in the bottom of the gas-making chamber which are readily cleanable without disturbing the fire. When the slicer bar enters the little port holes it cuts its way through at the point that should be reached. After this operation a series of blow flame pipes may be seen merging in the lower fire pot to enter the gas-burning section of the boiler in the rear. (2) The problem of providing ample space for completely burning the gases has been solved by the peculiar design of the gas-burning sections, which also allow for a long fire travel. The company's experiments it is stated, completely demonstrated the need for ample flue room.



GURNEY DOWN-DRAFT BOILER.

These boilers are made in a variety of sizes comprising a complete series for both steam and water, ranging from 1250 to 9500 sq. ft. steam and from 200 to 15,675 sq. ft. water. The company recommends the following chimney sizes for the capacities listed:

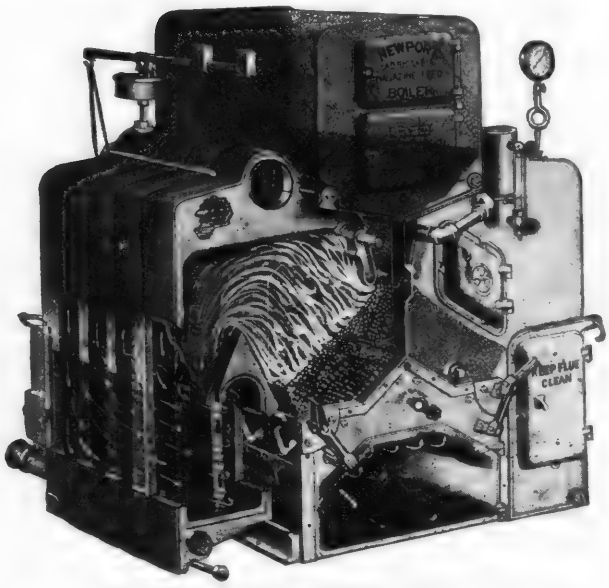
Amount of Radiation Sq. Ft.	Size of Chimney Flue Inches	Height of Chimney Flue Feet
1200 to 1500	12 x 12	40
1500 to 2500	16 x 16	55
2500 to 3000	20 x 20	60
3000 to 3500	20 x 20	65
3500 to 3800	20 x 20	70
3800 to 4200	20 x 20	75
4200 to 6500	24 x 24	75
6500 to 8750	24 x 24	80
8750 to 10000	28 x 28	80
10000 to 10500	32 x 32	80
10500 to 13000	32 x 32	90
13000 to 14000	36 x 36	90
14000 to 14500	36 x 36	95
14500 to 15000	36 x 36	100

2—NEWPORT ADJUSTABLE MAGAZINE-FEED BOILER.

In the days before fuel economy became so important as it is now, designers of boilers for heating purposes paid scant attention to features relating to economy, being concerned chiefly with the problem of putting out a boiler at a minimum of factory cost that would furnish steam at 2 lbs. pressure.

But times have changed since then. The discovery has been made that there are immense quantities of fuels outside of the "domestic" sizes which can be utilized at a great saving in house-heating boilers. But boilers of the ordinary type cannot use such coal successfully and the problem then became one of designing a heater that would burn either bituminous or anthracite coal and coke and do it with economy and without smoke.

One of the successful types of "smokeless" boiler is that manufactured by the Newport Boiler Co., Chicago, Ill., under the name of



NEWPORT BOILER WITH ADJUSTABLE MAGAZINE FEED.

the Newport adjustable magazine-feed boiler. This heater was not only designed to use the cheaper grades of fuels, but has the further advantage of being able to handle the larger sizes. This is accomplished by a movable throat which can be adjusted to any size coal, large or small, and for the exact depth required for the fuel being used. The importance of this will be appreciated when it is stated that during the war all heating engineers agreed that the first essential of good combustion was a proper thickness of the fuel bed.

Reserve fuel in the Newport boiler is held in an extra-large magazine out of contact with the fire, so that only the fuel in process of combustion is in the fire-box. Attention to the fire is, therefore, eliminated through very long intervals.

Good boiler design provides for perfect combustion, but should not stop there. The heating surface must be so designed and so located as to absorb and transfer the heat efficiently. The flue arrangement and the draft control in the Newport boiler, it is stated, has been found to result in the desired conditions of gas travel, draft control and heat transfer.

One of the greatest sources of waste in ordinary heating boilers is due to intermittent overheating. This loss is avoided in the Newport by having the exact amount of fuel required always on the grate, by the arrangements for the mixture of air, provision for combustion, the design of the heating surfaces, and by close control of the drafts.

While the Newport boiler is enjoying a wide sale in the United States and Canada the manufacturers attribute its success largely to its ability to get along on any and all kinds of coal.

3.—RICHMOND DOWN-DRAFT BOILER.

Basing its claims largely on its exceptionally long fire travel, in addition to its magazine feature and its ability to burn practically any kind of coal, the Richmond standard down-draft boiler is an important recent addition to the growing family of smokeless boilers. It is manufactured by the Richmond Radiator Company New York, and while only recently placed on the market, bears a patent date of March 10, 1914. Since that time the boiler has undergone the ordeal of severe tests bearing

CONSTRUCTION OF RICHMOND DOWN-DRAFT BOILER

on every feature of its design and construction, being now perfected to the point where the manufacturers offer a sweeping guarantee as to its economy in coal, its capacity for heating, the minimum of attention it requires, the readiness with which it may be adjusted to burn either hard or soft coal, its indestructibility, and the ease with which it may be erected.

One of the unique features of the boiler is that the smoke pipe connection can be taken off at either the right-hand or left-hand side. With this arrangement there is no trouble in getting the boiler close to the smoke flue, no matter where the chimney may be located.

Considerable ingenuity has been shown in lengthening, as far as possible, the course of the gases through the boiler. The draft goes first downward through the fire, then across the combustion chamber at the bottom. The course is then upward through the vertical flues through to the top. After passing across the top to the front, the gases flow downward again into the large flue or gathering chamber at the front. They then pass longitudinally across the front to the right or left, according to the location of the smoke-pipe connection, and leave the boiler through the two smaller flues to the smoke-pipe, at the opposite end. The two vertical flues (A) from the top of the combustion chamber, as shown in the accompanying illustration, are arranged and are of such a size that a constant stream of fire passes up these flues into the top of the boiler (B). They impinge at this point against water-backed surfaces and then turn across the top of the boiler so as to utilize every possible unit of heat left into the gases by conducting these gases into the large horizontal flue or gathering chamber (C), and thence out, as stated, through the two smaller flues (D) to the smoke-pipe.

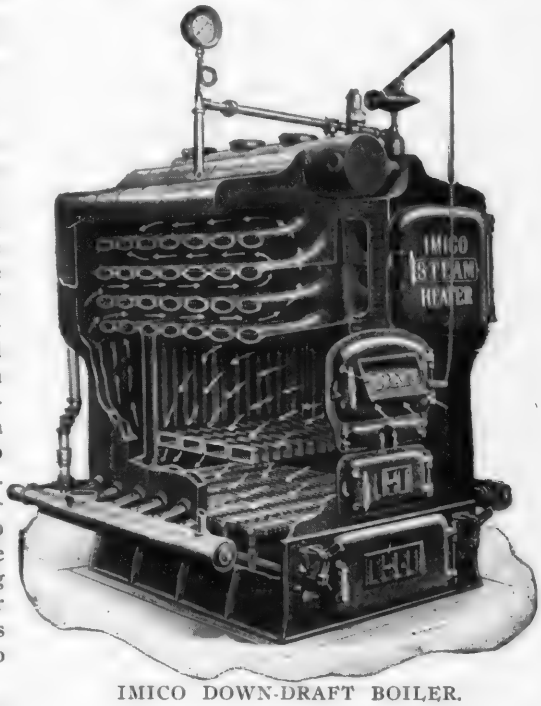
The magazine of the boiler, it is stated, will hold from 180 to 450 lbs. of surplus coal, according to the size of the boiler. When anthracite is used, the magazine's capacity is sufficient to run the boiler, under average heating conditions, from 12 to 24 hours without recoaling.

The boiler is in sectional form and is shipped knocked down. It is figured that the only extra time spent in erecting it, as compared with the ordinary type of sectional cast-iron boiler, is about an hour for connecting the water-front and attaching the magazine-feed. It is but a little over 5 ft. high.

The manufacturers offer a full series of sizes for both water and steam.

4.—IMICO BOILERS.

The Imico type of house-heating boiler, manufactured by the Illinois Malleable Iron Co., Chicago, Ill., is adapted for burning anthracite or bituminous coal, coke or wood. Care has been taken in its design and construction to avoid inaccessible surfaces that might become clogged. In this boiler, which, it will be noticed, is of the down-draft type, the waterways are vertically inclined, while the fire surfaces are horizontal, contributing largely to the circulation which is described as being effected with quick separtion of steam from water. An additional factor in promoting circulation is the fact that each section has independent internal circulation.



IMICO DOWN-DRAFT BOILER.

A point peculiar to the Imico boiler is the perfect alignment which is secured, due to the use of special machinery for this purpose. It is stated that this feature is not possessed by another screw-connection boiler. The boiler has a rocking grate, to be shaken by lever, so that dumping is not required to clear out clinkers. The rocking action of the grate is intended to grind up the ashes and clinkers. The grates of all except the smaller sizes are shaken by two sets of levers, each set controlling one-half of the grates.

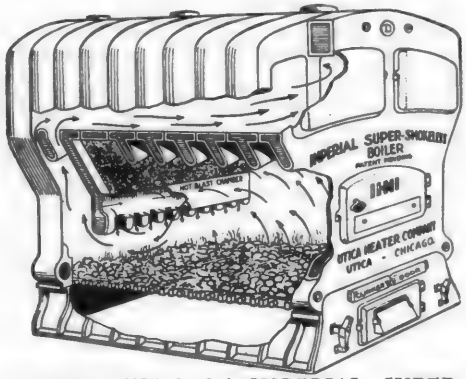
As stated, ample provision is made for cleaning the boiler. The last section may be cleaned from the back, while all other sec-

tions are easily reached through the front clean-out doors.

The boilers are made in two full series for water and steam heating, there being eight sizes in each series. In the steam series the capacity range is from 2600 to 5400 sq. ft. of direct radiation and, for water radiation, from 4300 to 7600 sq. ft.

5.—IMPERIAL "SUPER-SMOKELESS" BOILERS.

Differing in an important particular from the ordinary type of smokeless heater is the Imperial "Super-Smokeless" boiler, manufactured by the Utica Heater Co., Utica, N. Y. This heater operates with an updraft and is constructed with a single grate. The air necessary for burning the various grades of coal to which it is adapted, ranging from anthracite to the lowest grades of soft coal, is admitted to the combustion chamber through a hollow baffle or "water-curtain" section at the rear of the boiler, surfaced with a special high-fire test cement. The "water-curtain" also serves to break up many of the soot particles. This air is taken from the outside of the boiler through air inlets on each side, at a point opposite the hot-blast chamber.



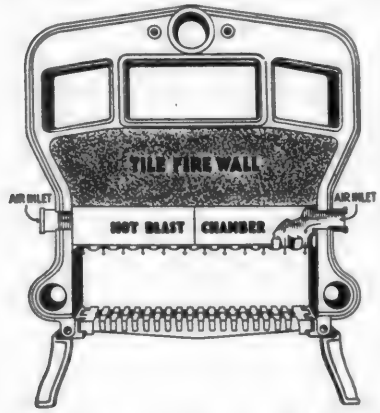
CONSTRUCTION OF IMPERIAL SUPER-SMOKELESS BOILER.

After being intensely heated in the chamber the air is injected into the combustion chamber at a point where it meets the smoke and soot just as they leave the baffle wall. A white flame is thus produced which travels with the flues, taking the place of the unburned gases in the ordinary type of boiler. These hot gases ignite any unconsumed gases as they pass along, serving to keep the flues clean and at the same time superheating the steam.

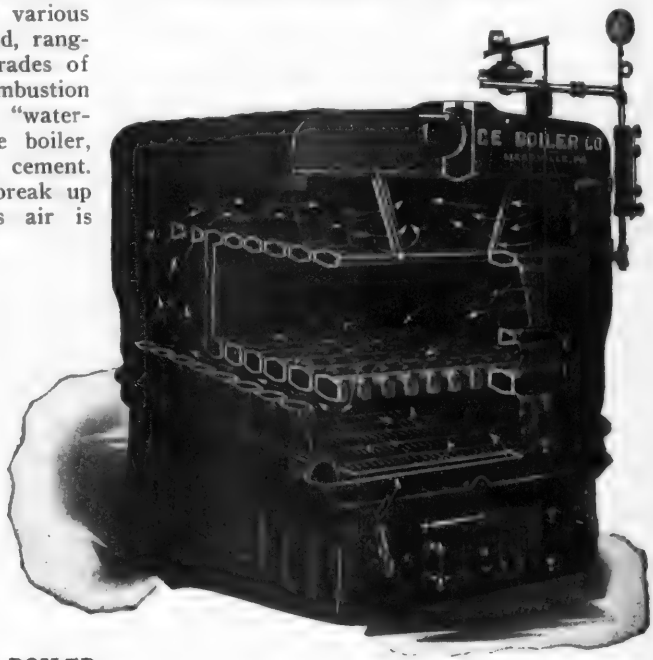
The boilers are made in a full line of sizes for steam and water.

6.—MONARCH DOWN-DRAFT SMOKELESS BOILER.

A performance test of the Monarch down-draft smokeless boiler, made not long ago at the Pittsburgh Testing Laboratories, gives as striking evidence as could be offered of the important economical features of the down-draft type of heater. It also constitutes a tribute to the design and construction of the Monarch boiler which lends special interest to its construction features. This boiler is of the double-grate type. The upper grate is cast integral with the boiler section, each bar being not only hollow, but of the same shape as the boiler section of which it is a part. In this way the water-grate forms one of the most effective parts of the heating surface in the boiler.



TILE FIRE WALL IN IMPERIAL BOILER WHICH SERVES TO BREAK UP SOOT PARTICLES.



MONARCH DOWN-DRAFT BOILER.

The fact that the high efficiency shown in a test of a down-draft heating boiler led to its adoption by the school board in one of the principal cities of the country lends a timely interest to the data obtained from the test itself. The school board in question is that of Pittsburgh, Pa., and the boiler is of the Monarch type, manufactured by the Wm. H. Page Boiler Co., New York. The test was conducted in the Pittsburgh Testing Laboratory by R. W. Thompson, under the direct supervision of J. P. Freeman, engineer of tests. Following are the figures obtained:

DIMENSIONS.

Name of Boiler	Page Monarch, No. 44-9 (Rated for 4800 sq. ft.)
Kind of Boiler	Down-Draft Smokeless
Grate Surface (width 44 in, length 49 7/8 in.)	15.2 sq. ft.
Total Heating Surface	249.1 sq. ft.

DATA, DURATION, ETC.

Date	March 27, 1918
Duration	10 hours
Kind and size of coal	Pittsburgh run of mine bituminous

AVERAGE PRESSURES, TEMPERATURES, ETC.

Steam pressure by gauge	2.5 lbs. per sq. inch
Average temperature of feed water	49° F.
Average temperature of outside air	31.8° F.
Average boiler room temperature	84° F.
Average flue gas temperature	521° F.
Percentage of moisture in steam assumed, zero per cent	
Factor of correction for quality of steam	1.

TOTAL QUANTITIES.

Total weight of coal as fired	1809 lbs.
Percentage of moisture in coal as fired	1.75%
Total weight of dry coal	1776 lbs.
Ash clinkers and refuse (dry)	155 lbs.
Total combustible burned	1621 lbs.
Percentage of ash and refuse based on dry coal	8.7%
Total weight of water fed to boiler	17603 lbs.
Total water evaporated, corrected for quality of steam	17603 lbs.
Factor of evaporation, based on temperature of water entering boiler	1.171
Total equivalent evaporation from and at 212 deg.	20623 lbs.

HOURLY QUANTITIES AND RATES.

Dry coal per hour	177.6 lbs.
Dry coal per sq. ft. of grate surface per hour	11.7 lbs.
Water evaporated per hour, corrected for quality of steam	1760 lbs.
Equivalent evaporation per hour from and at 212 deg. plus	2662 lbs.
Equivalent evaporation per hour from and at 212 deg. per sq. ft. of water heating surface	8.28 lbs.

CAPACITY.

Evaporation per hour from and at 212°	2062 lbs.
Rated capacity per hour from and at 212°	1125 lbs.
Percentage of rated capacity developed	183.3%
Water fed per lb. of coal as fired	9.72 lbs.
Water evaporated per lb. of dry coal	9.90 lbs.
Equivalent evaporation from and at 212° per lb. of coal as fired	11.30 lbs.
Equivalent evaporation from and at 212° per lb. of dry coal	11.6 lbs.
Equivalent evaporation from and at 212° per lb. of combustible	12.7 lbs.

EFFICIENCY.

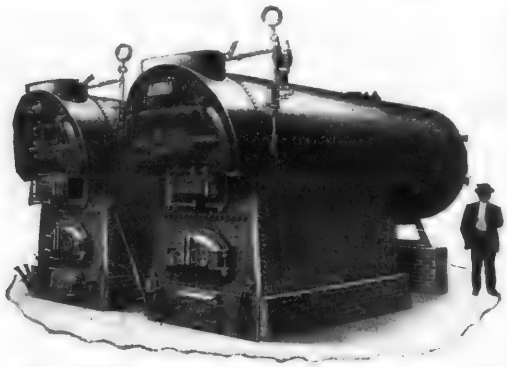
Calorific value of 1 lb. of dry coal by calorimeter plus	13905 B. T. U.
Calorific value of 1 lb. of combustible by calorimeter	14950 B. T. U.
Efficiency of boiler, furnace and grate	81%
Efficiency based on combustible	82.2%

SMOKE DATA.

Percentage of smoke as observed	0%
Average CO_2	9.9%
Draft at damper	0.34 in.

7—OIL CITY SMOKELESS RETURN-TUBULAR FIRE-BOX BOILER.

Unlike the other types of smokeless boilers here described, the Oil City boiler is of the return-tubular type, with a fire-box fitted with a water or down-draft grate. The desirable features of the locomotive and horizontal-tubular types have been combined by adding the return flues of the horizontal-tubular boiler to the internally-fired locomotive type, eliminating



"OIL CITY" SMOKELESS RETURN-TUBULAR FIREBOX BOILER.

from the former the brickwork setting.

Although these boilers are sold for low-pressure heating purposes the construction, such as thicknes of plates, details of laps, spacing and size of rivets, size and spacing of stay-bolts and braces, are designed to meet the requirements of approved practice for high-pressure work. The boilers are tested to 150 lbs. hydrostatic pressures, in addition to a critical inspection, before shipment. They are built entirely of flange steel.

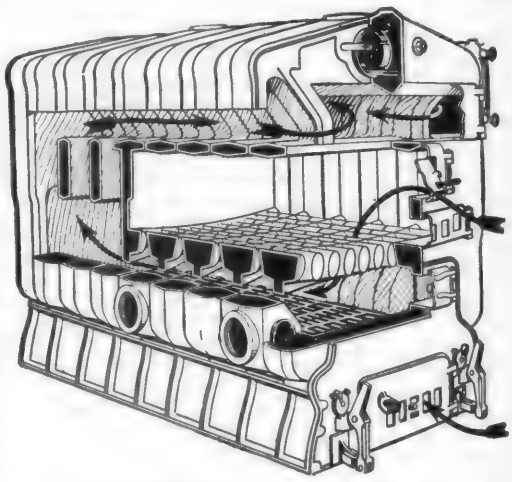
The heads of the boiler are all flanged at one operation to produce a smooth, even flange of large radius and thus avoid any injurious effects from repeated heating and cooling and hammering. The crown sheet, also, is braced to the outer shell by stay bolts and not by crown bars. The two upper rows of stay-bolts on the side of the fire-box are hollow stays. Lap-welded mild steel is used for the tubes.

The Oil City boiler is made in eighteen sizes ranging from 36 in. to 72 in. diameter of shell, the corresponding steam ratings being from 2,000 to 16,000 sq. ft. It is manufactured by the Oil City Boiler Works, Oil City, Pa.

8—IDEAL SMOKELESS DOWN-DRAFT BOILER.

A boiler designed for soft coal exclusively is that manufactured by the American Radiator Co., Chicago, Ill., under the name of the Ideal smokeless down-draft boiler. This heater makes use of the down-draft principle, the upper grate being charged with green bituminous coal which distilling downwardly through the grate slowly liberates its volatile heat-making gases. Meanwhile, it is stated, the resulting incandescent coke is continually dropping upon the lower grate where it burns in a glowing bed. In addition to the air admitted through the fire-door, additional air enters through the lower grates through the incandescent coke bed, as well as across its surface, the two currents of air meeting and mixing with the volatile gases issuing downwardly from the upper grate. The proportions have been carefully worked out to obtain immediate and complete combustion of the gases without smoke.

Each upper grate bar is a cast part of the boiler section itself and is hollow like the boiler section. Care has been taken to have its inner areas ample for free and unobstructed circulation of the water, while the free area through the



IDEAL DOWN-DRAFT BOILER.

grate or the spaces, between the water grates and their hollow projections, are also generous. In this way the draft is not choked, while the coked coal can easily be sliced through to feed the fire on the lower shaking grates.

The cheapest soft coal, it is stated, can be burned in this boiler and, at the same time, comply with any existing smoke ordinance. Another important feature mentioned in its construction is that the boiler is easily adaptable for burning gas, as practically any type of gas burner may be

easily attached or removed. Being made in section form the boiler is as easy to install in old buildings as in new.

One of the important minor features of the boiler is its equipment with a toggle fire-door for hand control, this door being suspended from the center instead of from the end, and thus allowing an even distribution of air into the fire-box. The boiler is made for both steam and water heating, comprising eighteen sizes of each type, ranging, for steam from 1,500 to 10,800 sq. ft. radiating capacity and, for water, from 2,450 to 17,300 sq. ft.

UNDEVELOPED OPPORTUNITIES IN THE FIELD OF DRAFT REGULATION

When the possibilities of draft regulation are considered in the way of economy of coal consumption and satisfactory results in heating, it is a matter for comment that this field has not been developed more fully than it has, especially with reference to house-heating plants that were installed previous to the recent advances in vapor, steam and water heating. As for warm air furnace heating the statement applies to a large percentage of the most recent installations. In such cases it is not the rule, but rather the exception, to find a heating plant equipped with automatic draft regulators yet there is no other item in the operation of a heating system that contributes so much to the comfort and health of the owner, as well as being a vital factor in keeping his coal bills down to the minimum.

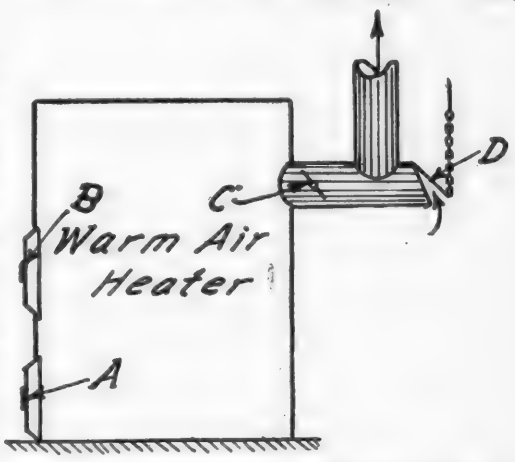
One point that heating men frequently forget is that while such devices as damper regulators are elementary matters to them, they are not so simple to the house owner. The average house owner, for instance, does not realize that there are, or should be, four dampers attached to his heater and is quite likely to have a wrong conception of the function of damper C, shown in the accompanying sketch. The question is frequently raised by him as to the necessity for its use under the assumption that damper B accomplishes the desired result. The latter damper, of course, is closed to obtain the full chimney draft and draw the gases through the heater. The owner should be told why the furnace draft is reduced when this damper is opened and how the air drawn from the cellar into the open end of the smoke pipe will reduce the draft.

It is not an uncommon thing to be told by the owner that when the fire is banked owing to a slight demand for heat, the draft is so strong that it is difficult to control the fire and keep it down. He is not aware that his trouble is due to his not making use of damper D, because with the draft indicated, the volume of smoke and gases could not pass the reduced area of the smoke pipe caused by the throttling effect of the damper.

Much depends on the size of the chimney and owners, as well as builders generally, should be made to realize how much the available draft is determined by the height of the chimney and the elevation of its top with respect to adjacent roofs, buildings or trees.

It is surprising to see how much ignorance is displayed by the house owner as to the purpose of damper B in the firing door and it is difficult sometimes to make him understand that this damper is not merely a means for observing the state of the fire, but is primarily for the admission of the air required to consume the gases arising from the fire. This, of course, is especially true in burning soft coal, when the damper should be opened for a short period to consume the increased volume of gases. In fact, while it may be fully closed when burning hard coal, it should be partially open all the time when soft coal is used.

Sometimes, to reduce the draft, both the firing door and the ash door are left open. It is true that the fuel continues to burn,



PROPER ARRANGEMENT OF DAMPERS IN HOUSE HEATER.

but at a slower rate. On the other hand, the cold air over the fire chills the furnace and but little heating results, as the excess air heated by the fire passes up the chimney.

It should be remembered that the rate of combustion is determined by damper A, located in the ash-pit door, and by damper D. Even at that, damper A should not be entirely closed and used alone for reducing the draft, since failure to check the draft, by dampers C and D will result in air being drawn in by leakage around the firing door. No doubt the closing of the ashpit damper decreases the rate of combustion, but the air drawn in above the fire is not proportionate to the fuel consumed, which explains why the excess air is heated only to be wasted up the chimney. This method also tends to form clinkers and to warp the grate bars, if often repeated.

A simple rule for the owner to remember is that to increase the fire, close the check draft damper D and open the ashpit damper A. To decrease the fire, open check-draft damper D and partially close ashpit damper A.

DEVICES FOR AUTOMATIC DRAFT CONTROL.

There are numerous devices on the market that will appeal to the owner and builder with renewed force when he has grasped the fundamental principles of draft control.

LEGAL DECISIONS

Liability of Mortgagee for Installing Heating Plant.

The Masachusetts Supreme Court holds, F. W. Zemier & Co. v. Beacon Im. Assn, 122 N. E. 719, that to charge a mortgagee of garage premises on an implied contract to pay for installing a heating plant, it must appear that the work was performed under circumstances warranting a finding that the contractor expected the mortgagee would pay for it, and that the mortgagee permitted such expectation and allowed the contractor to act without objection. The mere fact that the mortgagee made entry on the premises to foreclose is held insufficient to charge it with liability.

Parol License to Install Steam Heating Pipes.

The Iowa Supreme Court holds, Green v. Crain, 171 N. W. 574, that a parol license from the owner of a lot and first two floors of building thereon to the owner of the third floor to install steam pipes, having been executed at large expense to the owner of the third floor with the full consent of the owner of the others, vested in the owner of the third floor an irrevocable license to maintain the improvements in as efficient a positon as when installed, though the owner of the other floors could rearrange the installation if that did not interfere with its efficiency.

Maximum Charge for Steam for Heating.

A city filed a bill to restrain a light and power company from establishing a higher rate than 45 cents per 1,000 pounds for steam used for heating purposes, and also for an accounting. On July 1, 1917 the company established a new rate of 75 cents per 1,000 pounds, which had continued in force. At the time of the trial coal was worth more than $6 a ton. The franchise possessed by the defendant was granted August 5, 1913, and extended for 30 years. The question was whether the franchise limited the company to a 45 cent maximum charge on each 1,000 pounds of steam, irrespective of the price of coal. This must be determined from the construction placed upon that part of section 6 of the franchise which read as follows:

"It is hereby understood and agreed that the rates for heating herein established are relative to the cost of fuel at the present time, which is $2.80 per ton of run-of-mine of good bituminous coal containing 14,000 heat units per pound, and said Citizens' Light & Power Company, its successor or assigns, shall establish new rates on July 1st of each year; such rates when so established to be relative to the contract price of fuel at the time of such change. It being understood that fuel at the present time represents 70 per cent of the maximum rate for heating.

"The maximum rates to be charged under this franchise shall not exceed the following: For current, for power or light, 14 cents per M. watts (K. and W.). For steam 45 cents per thousand pounds. For hot water, 18 cents per square foot of radiating surface per year, but the rates for heating shall vary according to the ratio above specified."

The Michigan Supreme Court held, City of Adrian v. Citizens' Light & Power Co., 171 N. W. 485, that this language did not, as contended by the city, limit the company to 45 cents maximum charge on each 1,000 pounds steam, irrespective of the price of coal and affirmed decree dismissing the bill.

NOW IS THE TIME TO APPLY THESE HINTS

An opportunity for the heating contractor to get in touch with present and prospective clients is afforded by the following hints on coal saving which can be made the basis of a circular or personal call.

Have your heater thoroughly cleaned and put in good order throughout. Reduced efficiency and increased coal consumption are the inevitable results of the accumulation of soot, ashes and dust on the exterior of all types of heaters, and scale and sediment inside of steam and water boilers.

See that the smoke-pipe is in good condition. If badly rusted, the chances are that it is full of tiny holes that will considerably reduce the draft.

Be sure that the various dampers and drafts are in proper working order. See that there is a cold-air inlet, or check draft, in the smoke-pipe, in addition to the turn damper. In operation the fire should always be controlled by this check draft, and the turn damper should ordinarily be kept nearly closed.

The long iron poker furnished with each heater is for use principally for removing clinker masses interfering with the turning of the grates. Do not poke the fire from the top. This is apt to result in separating and turning over the live coals and, very likely, extinguishing the fire.

Keep the ashpit well cleaned out. The accumulation of ashes at this point not only cuts down the draft but may result in the burning out of the grates. This is not only because of the hot coals in the ashpit but is due as much to the fact that insufficient cold air reaches the bottom of the grates.

Banking the fire at night is not necessary if the heater is controlled by a thermostat, set to maintain a lower temperature at night than in the daytime. Even with no thermostat there is a question as to the advisability of banking the fire, especially in very cold weather when it is necessary to force the fire in the morning to bring up the temperature to the comfortable point.

Keep the fire-pot well filled with coal. Better control is obtained by doing this.

With warm-air furnaces, suitable moistening devices are of the greatest importance. The ordinary water-pan in the side of such furnaces is usually too small and is seldom attended to, so that most of the time it is without water. There are plenty of air-moistening devices on the market for warm-air furnaces that have means for automatically replenishing the water supply and are of sufficient capacity, as well as having control attachments to prevent excessive evaporation.

With steam and water heating systems, attachments may be had for containing water, to be evaporated by the heat from the radiator. Devices are also made for admitting steam or vapor directly into the room. If these are used care should be taken to drain the boiler occasionally and fill with fresh water to prevent unpleasant odors.

Airing of rooms occasionally is recommended. The invigorating effect of fresh, pure air makes a slightly lower temperature comfortable.

Storm windows and weather-stripping, especially of the metal type, are important items in saving fuel. This is particularly true in frame houses where the windows and window-frames permit a surprising amount of cold air to leak in. It has been demonstrated that drawing down the window shades at night is an effective way to save fuel.

Cover hot-air pipes with asbestos paper, and put a heavy coating of plastic asbestos or other suitable insulating material on steam and hot water pipes in the basement. If the heater is set in brick-work, be sure that all cracks are cemented through which air might leak into the firebox.

MODERN PRACTICE IN VAPOR HEATING

EDITOR'S NOTE: *For the purpose of this series of articles, a vapor, vacuum, vapor-vacuum, vacuum-vapor, atmospheric, modulated or thermograde system of heating will be considered as any system in which the steam pressure ordinarily carried is practically at atmosphere or slightly below or in which the returns are open to the atmosphere and where no pump or other positive mechanical device is employed to pull back the returns.*

XIV—THE TRANE SYSTEM (LARGE INSTALLATIONS.)

In THE HEATING AND VENTILATING MAGAZINE for June, 1919, under the title of "Modern Practice in Vapor Heating," a description was presented of the Trane system, manufactured by the Trane Co., La Crosse, Wis. This system was described as more particularly adapted to small installation of 400 sq. ft. or less, in which return fittings are used on the radiators. This is in accordance with the recommendations of the company.

But for larger installations, the company recommends the use on the radiators of the Trane Thermetal trap, in place of the return fitting, and a direct-return trap at the boiler, in place of the receiver.

A typical layout of such a system, with the Thermetal trap installed on the radiators, is shown in Fig. 1. The other specialties used consist of the vapor regulator, for controlling the draft; the direct-return trap, for keeping the water in the boiler at all times, regardless of pressure; a float vent trap, which exhausts the air from the system and prevents the waste of any steam or the return of any air into the system; and the ounce pressure gauge at the boiler. These specialties, together with the graduated supply valve at the radiator inlet, complete the system.

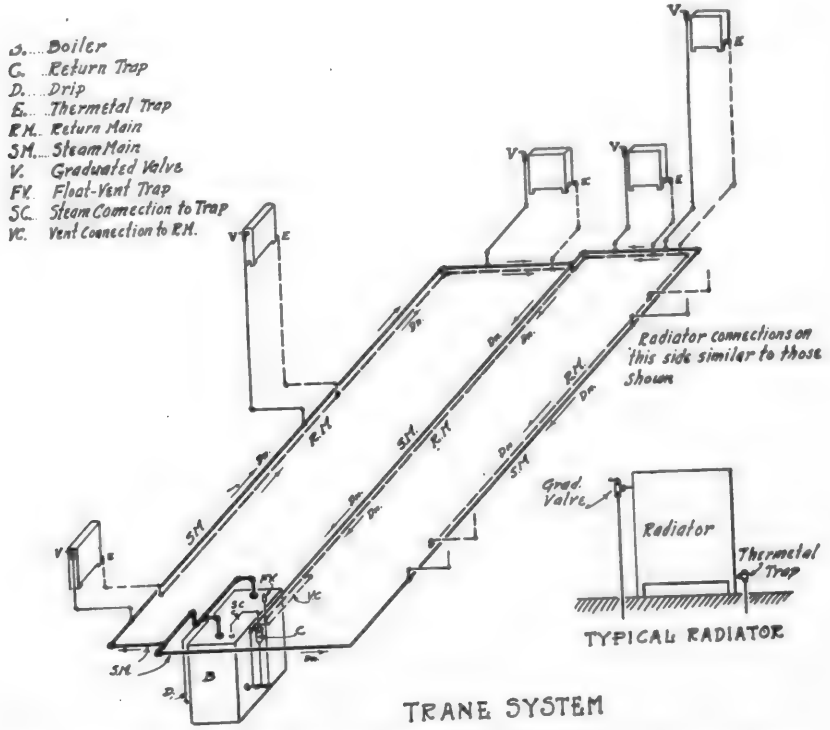


FIG. 1—LAYOUT OF TRANE SYSTEM FOR LARGER INSTALLATIONS.

The previous article explained how the receiver on the small Trane system makes the system safe, regardless of pressure. On the larger installations, using the Thermetal trap, the direct-return trap is the device used to make the system safe, regardless of the pressure. If for any reason, due to faulty handling or mismanage-

ment, the fire is allowed to burn too vigorously and a pressure is created on the system so that the water will not return by gravity, the water fills up the body of the direct-return trap, lifting the float and finally, when the float reaches the top, the

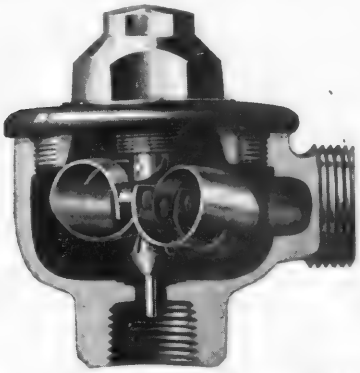
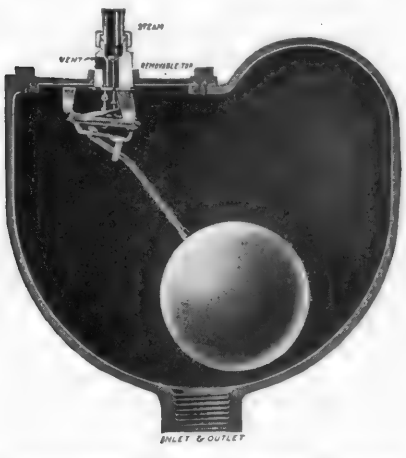


FIG. 2—CONSTRUCTION OF TRANE THERMETAL TRAP.

steam valve in the top of the direct-return trap is opened, forcing the water back into the boiler. The vent valve on top of the direct-return trap is also closed so that steam will not pass into the returns.

When the water is forced into the boiler the float lowers and again operates the steam and vent valve, closing the steam valve and opening the vent valve, so as to equalize the pressure in the direct-return trap body with that of the return piping, thus allowing the water to again flow into the direct-return trap body by gravity. This operation is continuous so long as there is pressure on the boiler in excess of that required.

The manufacturers advocate the use of a



CONSTRUCTION OF TRANE DIRECT-RETURN TRAP.

direct-return trap on all gravity plants where the radiators are equipped with traps, because on such plants there is always a difference in pressure between the supply and the return, due to the operation of the radiator trap.

The fact that the Thermetal trap is a recent development lends special interest to its construction and operation. It is a thermostatic trap, but instead of being actuated by a mass of liquid, this function is performed by a mass of metal. The unique construction of the trap stamps it as one of the most remarkable that has been developed for this class of work. Through a circular construction of the operating mechanism, it is pointed out, the unusual expansion per degree difference has been obtained while, at the same time, a straight-line motion makes it adaptable to the ordinary type of thermostatic trap. Further, it is affected by temperature only, and not by pressure. This makes it an easy matter to design these traps for various differences in pressure of steam.

Britain Facing Huge Coal Problem.

The British government, after announcing a six shilling ($1.46) increase per ton in the price of coal, to take effect July 16, has now put the issue squarely up to the miners by offering to postpone the increase for three months, provided the miners will undertake to "get their backs into it" and pick up Great Britain's alarming drop in output. The secretary of the Underground Electric Railways has stated that his company could have Philadelphia coal delivered into its Chelsea generating station at 42 s. ($10.50) per ton and if there is any difficulty in the matter, it is with its storage capacity. The Scottish coal the company is now using is costing over 50 s. ($12.50) per ton. Similar statements as to the advantage of American coal, even on the British markets, are heard on all sides in England, and the export trade, particularly in South America, is looked upon as impossible in competition with America.

In the iron and steel trades the American Chamber of Commerce in London reports similar conditions. A representative of a large Manchester iron and steel company said that the coal increase would make steel £2 ($10.00 per ton dearer). American steel prices are already lower than British steel prices, and the explanation of Britain's ability to continue in business was that certain steel users found it convenient to trade with Britain.

The Trade Extension Bureau

Under this heading items will appear, probably each month, dealing with the important work of the Trade Extension Committee in helping to develop "bigger business" for those engaged in the heating and plumbing industries. The campaign of the committee, as already outlined in these columns, is not intended to be a "drive," as this term is commonly understood, but embraces plans for keeping the heating and plumbing contractors supplied with helpful hints and suggestions on such items as book-keeping, publicity and prospective business opportunities. It is likely that the Bureau will become a permanent institution, acting as the trades' national "press agent."

Standard Method of Estimating Heating Jobs.

Estimating is really the first work of the contractor in going after business. It is quite logical, therefore, that the Trade Extension Bureau, in conducting a systematic educational campaign to improve business systems, should devote its initial efforts to the subject of estimating as an aid to business efficiency. One of the first service bulletins to be issued by the bureau sets forth a standardized method of estimating heating jobs. The bulletin was compiled by the staff of the Bureau from hundreds of estimating forms and methods submitted. Among the contributors are the largest heating contractors in the country who have thus placed at the disposal of the trade their short-cut methods.

The bulletin is a thorough discussion of estimating heating contracts only, written in a popular and non-technical style. Accompanying the bulletin are sample tabulating, computing and estimate sheets.

Let T. E. B. Be Your Best Friend.

Under this title the Trade Extension Bureau describes its activities as diagnosing and prescribing for the shops that show signs of failing health and those wanting to grow stronger. The bureau's staff of doctors are listed as:

Dr. Accountant, who heads the department of efficiency in bookkeeping, cost finding, estimating, credit extension.

Dr. Promotion, who analyzes problems of the trade and is especially interested in building strong business personalities by telling the contractor how to construct show-rooms and build store sales; and how to use show-windows as business builders.

Dr. Publicity, who is keen on prescribing circular letters that will bring business to the heating and plumbing contractor. He prepares advertising copy for the newspapers and advises his clients how best to divide the money to be spent for publicity.

The bureau's service is entirely free to the heating and plumbing contractors, for the Trade Extension Bureau, states the bulletin, is the business sanitarium endowed by the progressive manufacturers and jobbers of heating and plumbing material for the exclusive benefit of the trade.

If you are in the contracting business and failed to receive the questionnaire and the literature of the Trade Extension Bureau, send in your name and address at once to: National Trade Extension Bureau, Mercantile Bank Buidling, Evansville, Ind. The mailing list of the bureau is not as complete as it should be. Several letters have been returned as undeliverable because of incorrect address.

CORRESPONDENCE

Pressures in Air Ducts.

EDITOR HEATING AND VENTILATING MAGAZINE:

In a fan blast heating system, should the pressure, as measured by inches of water, in an air duct, say, 50 ft. long, be the same as in the longest pipe in the system which, we will say, is 300 ft. long, or should it be at the same rate per 100 ft.? I have several books on the subject, but they do not make this point clear. H. W. H.

Chicago, Ill.

In THE HEATING AND VENTILATING MAGAZINE for October, 1916, in an article by Harold L. Alt, various methods of sizing ducts and flues were outlined and examples given. These comprised in all seven different schemes which are illustrated and briefly

outlined in Standard Data Sheets Nos. 10-M to 10-W, inclusive. The reader is referred to the article in question for a more complete discussion of the subject. The systems as outlined are those usually employed by most engineering offices, since they are simple, easy and quick, and, therefore, more economical in the engineers' time.

In these the ducts are sized on the velocity basis. The factors which determine velocity are, economical speed of fans with respect to power, limited velocities due to noise or increasing friction with increase of velocity, limited velocity through register faces, and economy in the use of sheet metal. The sizing of ducts, as determined by velocities assumed at various points gives only approximate results, unless experience and good judgment are used, since dampers and deflectors are required to effect the proper distribution of the air. In small systems with short runs the results are sufficiently accurate, but with large systems the dampers may of necessity be set at abrupt angles to produce the necessary flow and this involves unnecessary resistance.

In an ideal system various factors, such as the velocity, size and length of ducts and number of elbows, are taken into consideration, and so the velocities are proportioned for a resistance equal in all ducts, regardless of length. In addition to economy of power and material, the distribution should be uniform without the use of dampers and deflectors. Where the branch pipes are of unequal length, the shorter runs will deliver more air than intended unless dampers are used, or unless the various branch pipes are designed for equal frictional resistance. This may be effected by using smaller ducts, with corresponding lower pressure loss and velocity.

This is what is known as the "drop in pressure" method; that is, the drop in pressure per unit of length is practically the same at any point in the main or trunk duct, irrespective of the quantity of air. The resistance is computed for the longest duct, including bends, or by assuming a total drop in pressure for the entire system which, divided by the total lineal feet of trunk duct, multiplied by 100, gives the drop in pressure per 100 ft. The drop in pressure must be the same from main to outlet in any branch duct as the drop from the connection to main duct to end of main, or any other branch outlet beyond.

The method as described involves the use of certain tables to make its application simple and quick. For this reason the correspondent is referred to "Designing Heating and Ventilating Systems," by Charles A. Fuller and to "Fan Engineering," published by the Buffalo Forge Company. Meier's "Mechanics of Heating and Ventilation" also goes deeply into the subject.

Code of Rules on Installation of Piping.

EDITOR HEATING AND VENTILATING MAGAZINE:

I am writing you to find out if you have any code of rules governing the installation of power and heating piping. If not, can you refer me to some one who has. We are drafting a code for the State of Ohio which will also cover refrigerating plants. C. E. McL.

Toledo, O.

We know of no code governing the installation of power and heating piping except the brief local laws of various municipalities as affecting blow-off piping and the fire stopping of heating pipes. For such matters information may be obtained from the following: Mutual Fire Insurance Co., 31 Milk St., Boston, Mass.; National Board of Fire Underwriters, New York; Bureau of Buildings Building Code, New York; and the Building Code, Chicago, Ill.

The Fuel Administration touched on this subject in a manual issued last year on "Fire Protection for Railroad Properties."

New Publications.

AIR CONDITIONING ENGINEERING is the title of an interesting booklet calling attention to the increasing importance of scientific ventilation in our modern industries and to the service offered in the field of air conditioning by William G. R. Braemer, consulting engineer, Stephen Girard Building, Philadelphia, Pa. The booklet emphasizes the inadequate conception on the part of the public of what ventilation means. "To the average person," it is stated, "ventilation means the agitation of air, and when he observes little streamers fluttering in the breeze escaping from a register on the wall, he is impressed with the fact that fresh air is being provided for his comfort, even though the air thus supplied is inadequate both as to quantity and quality. Here begins his self-hypnotism into a feeling of greater ease, for which there may be no real foundation, except a cause purely psychological." An idea is then given of the problems involved in applying heat in

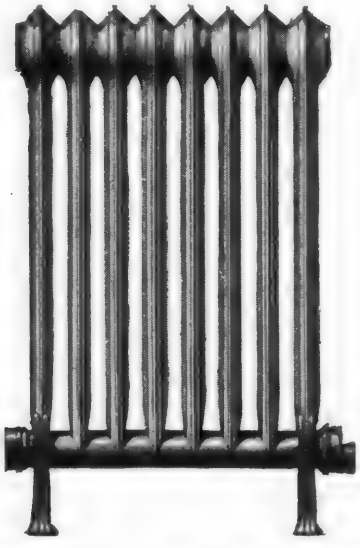
ventilating problems showing how important they are, not only for the comfort of individuals, but to the manufacturer in securing uniformity in quantity and quality of production. Mr. Braemer's associations for many years, it is stated, have been such as to enable him, as one of the pioneers in this line, to contribute towards working out the fundamental principles and the development of practical apparatus. Mr. Braemer is acting entirely independently as a consulting engineer for all classes of work involving air conditioning and drying.

PROCEEDINGS OF THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS for 1918 (Volume 24), recently issued, constitute a volume of 440 pages. The volume contains, among other things, the society's revised code for testing house-heating boilers, as well as reports of the development of the Research Bureau. It is published from the society's headquarters, 29 West 39th St., New York.

New Self-Draining Radiator.

"See that pipe across the bottom of our new Pressweld radiator?" said J. A. Irwin, of the American Pressweld Radiator Corporation, as he displayed the corporation's latest product, a self-draining radiator. "Well, sir, that's going to make a lot of heating engineers and architects mighty happy.

"See what it does. That pipe drains every drop of condensation out of the radiator.



NEW TYPE OF SELF-DRAINED PRESSWELD RADIATOR.

It eliminates all water pockets and water pockets have been the one possible objection to sheet-metal radiation. It provides increased heating area and greater air circulation between the radiator sections.

"We weld the sections securely into the pipe, as you see, making the radiator practically one solid piece. It is light, too, light enough to hang on the walls or ceilings, without strain.

"Have we issued any descriptive literature yet? Why, yes. We've just printed an attractively-illustrated folder, showing clearly how this new, self-drained radiator is built and works. Have your professional friends write us for a copy of this new folder, also a new catalogue that gives all technical data and measurements, together with tables of ratings. Just address the corporation at Detroit, Mich."

A New Duct Damper Regulator and Indicator.

A device that will be welcomed by the heating and ventilating trade has been brought out by the Sixth City Sheet Metal Works Co., Cleveland, O., under the name of the Perfecto damper regulator and indicator for regulating the supply of hot or tempered air in indirect heating systems. The advantage of the indicator is that it shows the position of the damper in the pipe. It is furnished with numbered or lettered cover glass windows to correspond with rooms to which each pipe leads. When in use it entirely prevents tampering by unauthorized persons.

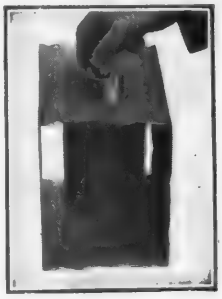
This device may be placed on the wall of a room where the ventilating ducts are concealed within the wall and the damper connected to it by an extension of the square damper rod. Such an arrangement is especially useful in school rooms to control the inflow of tempered air and exhaust of vitiated air. When the damper is set by the engineer or janitor it cannot be altered by anyone except the person in charge of the system.

When placed on a battery of ducts in the collecting chamber near the machinery room, the Perfecto damper regulator and indicator serves both for regulating the flow of air and as a means of indicating the room to which each duct leads.

In construction, the device consists of two stems with square holes to receive standard 3/8-in. square damper rods. The outer case has a notched rack to receive the indicator lever. One of the stems is fitted with washer and cotter-pin to hold the butt end

of the damper in the pipe. The other stem, which fits the inside case, is provided with pivoted finger piece which serves as a T-handle to turn damper when in an upright position and as a damper lock when pushed down into a slot of the notched rack inside of the case. The case or housing of the indicator contains a semi-circular slotted rack in which the pivoted T-handle is secured. Opposite this rack is a segment cam, notched to receive the key which actuates the locking mechanism. The cover, with its numbered or lettered glass window (furnished in any desired combination) cannot be removed without using the toothed key. This key forces the wedge-shaped edge of the segment cam between the spring latch and the inside of the case, withdraws the catch from its notch in the cover and allows the cover to be removed. Care has been taken to give the device a suitable finish so that it does not detract from the appearance of a room.

TURN DAMPER TO DESIRED POSITION.



PUSH HANDLE INTO SLOT WHICH HOLDS DAMPER IN POSITION.

SLIP COVER OVER LOCK WITH KEY.

HOUSING.

HOW TO OPERATE PERFECTO DAMPER REGULATOR AND INDICATOR.

A Record of Twenty-Five Years as Manufacturers of Fuel-Saving Devices.

Any firm that may point to a record of 25 years as manufacturers of a line of devices, every one of which is designed distinctly for fuel-saving purposes, has achieved a unique distinction worth noting in discussing the general subject of fuel conservation. The products of the Wright-Austin Co. of Detroit, Mich., to which this distinction applies, are in each case designed to reduce steam waste, save fuel and lower operating costs, the company's line embracing steam traps, oil separators, steam separators, alarm columns, pump governors, boiler-feed regulators and strainers.

Perhaps the company's most notable product, as a steam saver, is the Wright continuous-flow steam trap. Its value for use with a separator, the company states, has made its adoption desirable even if its cost is viewed simply in the light of insurance on the safety of the engine. The instantaneous action of the trap and its great discharge have always been pointed out as two of its most valuable features. The standard trap is made for pressures up to 200 lbs. without adjustment or change of any parts, while a special emergency trap is made for pressures up to 300 lbs.

This company is also the manufacturer of the Wright Victor low-pressure automatic continuous-flow steam trap for pressures up to 20 lbs. The Victor trap has gained a reputation for its large capacity, being especially adaptable for heating coils and evaporators where large quantities of condensation must be handled.

The company's line of steam and oil separators includes more than 15 standard patterns, with a separator for every purpose. Of course, where dry steam is desired or in cases where boilers are operated at nearly their full capacity, or where there is danger of water being carried over into the engine, the use of an efficeint steam separator is imperative. Also, if oil is not effectively removed from the exhaust steam, the oil will corrode the inside of pipes and surfaces through which the steam passes, acting as a non-conductor of heat and cutting down the efficiency of steam coils for heating or drying, or in evaporators, stills and similar apparatus. The company's success in this field has led to the production of an usually complete line of steam and oil separators. These with the Wright safety alarm water columns, exhaust heads, strainers, trimmings, vacuum oil separators and the Murray boiler-feed regulators and pump governors, complete a variety of devices that will indicate the wide extent to which the company's field has grown during its long connection with the industry.

Saving Fuel with Boiler Feeders.

The problem of today is that of saving, just as it was the big problem during the war and will be now that the war is over. This important topic is discussed in an interesting manner by F. C. Farnsworth, president of the Farnsworth Co., Conshohocken, Pa., manufacturers of condensation machines. Mr. Farnsworth has recently toured the country, having visited a number of big steam plants in Canada, the Northeast, in the West and among textile power plants in the South.

"A few months ago," said Mr. Farnsworth, "there was a lull in business. Today the manufacturers all over the country are really planning and doing bigger things than they ever have before and now, instead of a lull, it is 'speeding up' time. We are all going over the top, with big business chasing us at a mile-a-minute pace, and in spite of high prices are all asking, 'Why didn't I do this before?'

"Wise plant owners are just as careful about saving and cutting down waste in busy seasons as when they running at half capacity, so the problem of saving coal, with its continued high cost, is just as vital now as it ever was.

"'How can I save in my power plant?' asked one textile mill owner recently. I did not answer his question from a mere description of conditions. An inspection showed that he was simply throwing coal away by using the old hot-well system. There are half a hundred ways of wasting coal and this is one of the more common methods.

"When we stated recently that the Empire Oil Works of Oil City, Pa., had shut down one out of five 150 H. P. boilers after installing the Farnsworth system, they wrote back: 'You are mistaken and are too modest. We shut down a 200-H. P. boiler.'

"The fact is that the expert on fuel economy should be the most welcome visitor in thousands of steam plants in this country. It is worth the study, experience and knowledge the expert puts into his work to know that he is more than a mere salesman, that he is saving coal, saving money and preventing waste."

Mr. Farnsworth stated that he is experiencing some of that satisfaction in connection with the marketing of the latest types of Farnsworth machines. "They were built," he said, "to eliminate waste and are constructed without openings for waste of live steam. For that reason they are termed 'closed systems.' All plants waste coal if they do not drain their condensation from all of their high-pressure traps and feed it directly into the boilers under pressure at a high temperature.

"As an illustration, if you were to install a thermometer inside a common steam trap of any type, you would find that the temperature of the condensate, before it leaves the trap, is nearly that of the steam on the system that the trap is draining. Discharging the condensation from a high-pressure trap into a hot well allows the high temperature condensation to cool down until it becomes the same as that of the hot well, receiving tank or low-pressure heater.

If in a hot well, with the pump above the hot well, it is practically impossible to pump the water into the boiler at a temperature much over 180° F., while, if it is discharged into a receiving tank, it is then possible to pump the water into the boiler at about 200°, or, if it were discharged into a low-pressure heater, carrying a few pounds back pressure from the engine, it is possible to heat the water up to about 212°.

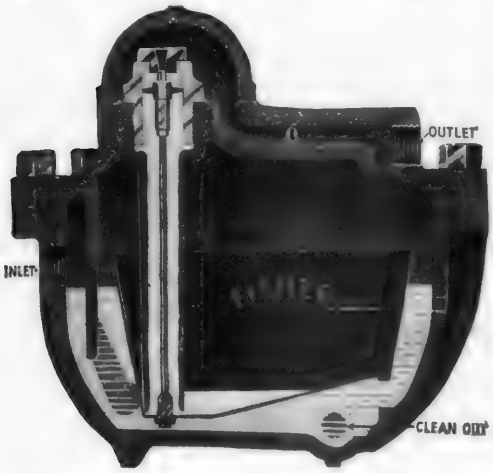
"When the water comes to a temperature of 212° or thereabouts the average pump will give a certain amount of trouble, and it becomes a difficult thing for the average pump to handle. There is when a device such as the Farnsworth duplex boiler-feeder has its greatest usefulness. Instead of going to the hot well, the water of condensation is carried direct to the boiler-feeder which has two chambers. One chamber is always receiving the condensate and the opposite chamber is always under pressure delivering the water into the boiler. The alternate filling and emptying of these chambers provides a continuous flow of condensate from the high-pressure traps directly into the boiler and at a high temperature.

"Some idea of what this item will run to may be gained from a simple calculation. For instance, if 500 H. P. were used for a 24-hour day, 396,000 lbs. of water would have to be pumped into the boiler, with a total loss of 47,520,000 B. T. U."

Trade Literature.

FISHER STEAM TRAP, described as a strong, simple, positive-acting device for removing condensation from steam lines, with but two parts susceptible to wear—the valve and the seat, are brought to the attention of the trade in a new catalogue issued by the Fisher Governor Co., Marshalltown, Ia. Each detail of construction of the trap is illustrated by photographic views so that an idea of the trap's merits may be had almost without referring to the text. These illustrations describe successively

how easily the cap comes off giving access to the interior, the short time required to change a seat or valve, the large orifice of the valve seat, the short fulcrum of the

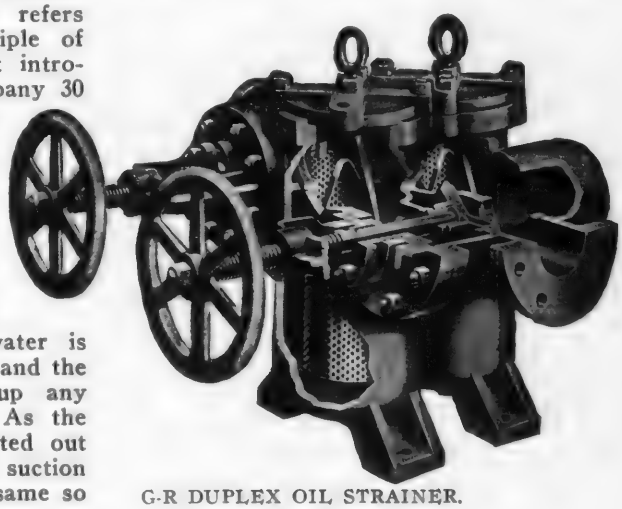


CONSTRUCTION OF FISHER STEAM TRAP.

large bucket, the double-bearing hinge of the bucket, the bucket itself which is characterized as a master-piece of casting, the two cleanouts at the lowest points, and the provisions for the water-gauge. The catalogue is gotten up with unusual care, both as to its arrangement and typographical appearance. In addition to dimension tables and list prices for repair parts, several pages are taken up with suggestive installations of the trap. Size 6 x 9 in. Pp. 24.

ECONOMICAL HEATING, with special reference to the Almirall system of water heating (forced circulation), is the title of an impressive booklet published by Almirall & Co., New York. The booklet refers to the introduction of the principle of forced circulation which was first introduced by Evans, Almirall & Company 30 years ago. In 1914 the firm was succeeded by Almirall & Company, Inc., and since then this method has been known as the Almirall system. The booklet describes at length the principal features in the construction of the system, such as the centrifugal pumps to circulate the water, the exhaust heaters in which the water is heated by means of exhaust steam, and the live steam heater for making up any deficiency in the exhaust steam. As the circuit is a closed one, it is pointed out that the static head on both the suction and discharge of the pump is the same so that the function of the pump is only to overcome friction due to the flow of water through the several pipe lines. The same water is used continuously. Special attention is directed to the feasibility of changing the temperature of the heating medium, with the Almirall system, to correspond with the fluctuating outdoor temperatures. Another point mentioned for this method is that the system will not create back-pressure on steam-using appliances when exhaust steam is used from such appartus. Also where there is available for heating purposes exhaust steam from apparatus of this type, the Almirall system will utilize the steam and at the same time a varying vacuum may be maintained on the apparatus. Curves are included showing an actual record of the performance of an existing system of this type, with the fluctuating out-door temperatures, the corresponding temperatures of the water in the Almirall system, and the resulting vacuum on the prime mover. The booklet contains an imposing list of installations, with photographs of some of the plants in which more extensive installations were made, such as the Allis-Chalmers plant, the Cincinnati General Hospital, the American Locomotive Works and the plant of the B. F. Goodrich Co. Size 7½ x 10½ in. Pp. 32.

G-R DUPLEX STRAINER, designed for installation in the suction or discharge lines of lubricating or fuel oil systems, for the removal of solid foreign material in suspension, has been placed on the market by the Griscom-Russell Co., 90 West St., New York, and is described in newly-published circular matter. This strainer is also suitable for straining the water supply

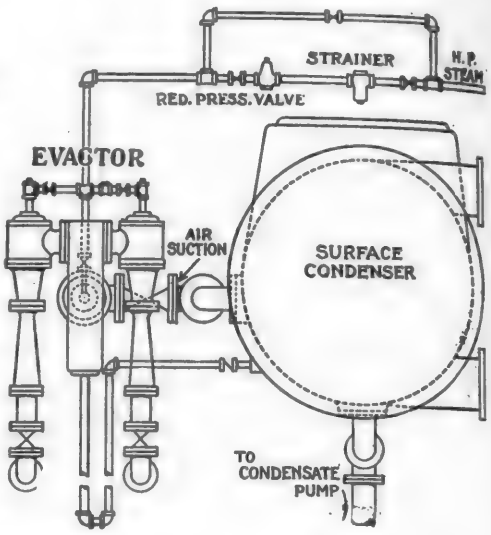


G-R DUPLEX OIL STRAINER.

from rivers and lakes to prevent weeds, sticks, small fish, etc., from entering the pipe lines. The strainer consists of a cast-iron body containing two perforated steel or brass baskets. The valve arrangement permits the complete removal and cleaning of either basket while the other remains in service.

WEBSTER AIR WASHERS are the subject of a notable engineering bulletin (No. 50) published by the Atmospheric Engineering Corporation, Philadelphia, Pa. This, with the company's previous bulletin (No. 120) are two of a series arranged for binding in loose cover. Additional bulletins will be issued from time to time and, when the entire series is completed, the company will furnish a heavy cover for permanent binding. The high standard shown in the previous bulletin is fully maintained in the new publication which will be valued by heating engineers looking for general, as well as specific information on humidity problems. Under the title of "The Permanent Place of the Air Washer in Heating and Ventilation Practice," a discussion is presented of earlier methods of air cleaning and of the developments that brought the Webster air washer to the front as one of the most effective machines of its kind. Following the quotations of experts on the subject, the bulletin takes up in detail the design and construction of the Webster air washer, with numerous detail views. This is followed by a section on the application of the Webster air washer for cleansing and purifying. Interspersed through the pages are many photographs of buildings with Webster equipment, the bulletin concluding with a description of special types of air washers for turbo-generator ventilation, and the Dr. Hill dust counter. Size 6 x 9 in. Pp. 56.

ROSS CONDENSING EQUIPMENT, with the Croll-Reynolds Evactor Air Pump, is featured in a newly-issued catalogue, with particular emphasis on the evactor air pump, which is described as having many features which will appeal to engineers where the highest possible vacuum is required with low steam consumption and upkeep. The evactor is further described as the most radical change in power plant equipment which has been placed on the market in recent years. It can be used with any type of condenser, evaporator, vacuum pan, or any apparatus where the best vacuum is desired. The principal advantages mentioned for it are the elimination of long pipe lines, no moving parts,



ROSS EVACTOR AIR PUMP ATTACHED TO SURFACE CONDENSER.

and the elimination of trouble due to carbonization of the oil in the air cylinders of the rotative dry vacuum pump. The evactor air pump consists of two or more steam ejectors acting in series. Between the steam ejectors is interposed an intercooler of either the jet or surface type, depending on the operating conditions. The first stage or primary ejector is attached directly to the condenser. Steam at boiler pressure is admitted to the jets contained in this ejector. The construction of these jets is such that the air and non-condensdenser, compresser in volume and disable vapors are withdrawn from the concharged into the intercooler. A small quantity of water is admitted to the intercooler, condensing the steam used by the primary ejector, cooling the air and noncondensable vapors thereby reducing their volume. The air and non-condensable vapors are removed from the intercooler and discharged to atmosphere by means of one or more secondary ejectors specially designed for this particular service. If the water used in the intercooler is of suitable character it can be readily utilized as make-up boiler-feed water. In this case the jet type of intercooler can be used. If the water is contaminated or salty a surface intercooler is used so that the condensation can be recovered for the boiler-feed system. The discharge steam from the secondary ejector can be readily utilized in heating the feed water or for any other purpose where low pressure exhaust steam is desirable. Size 6 x 9 in. Pp. 18.

Full List of Standard Heating and Ventilating Sheets Published to Date.

The publication of THE HEATING AND VENTILATING MAGAZINE'S standard data sheets has advanced to the point where a complete list of the sheets already published is in constant demand on the part of our subscribers and others who are making wide use of them in their daily work.

As one correspondent writes: "We are figuring heating jobs entirely from your data sheets, as far as the sheets go, and find them a great help. As soon as the sheets are more complete, such as those covering fan capacities and air washers, they will be the 'real cheese.'"

The following list includes all of those published to date:

No.	Title.
1.	B. T. U. Losses.
1-A.	B. T. U. Losses—Brick.
1-B.	B. T. U. Losses—Stone and Concrete.
1-C.	B. T. U. Losses—Combinations.
1-D.	B. T. U. Losses—Tile.
1-E.	B. T. U. Losses—Frame Construction.
1-F.	B. T. U. Losses—Glass, Skylight and Miscellaneous.
1-G.	B. T. U. Losses—Ceiling, Floor and Roof.
2.	Exposure.
3.	Leakage.
4.	Temperature Range.
4-A.	Temperature Range (Continued).
4-B.	Temperature Range—Proper Inside Temperatures.
5.	Computing Heat Losses.
5-A.	Computing Heat Losses—Example of Computation.
5-B.	Computing Heat Losses—Equivalent Direct Radiation Temperatures.
5-D.	Compound Heat Losses—Ventilated Rooms.
5-E.	Computing Heat Losses—Hot Blast Systems.
5-H.	Computing Heat Losses—Equivalent Hot Blast Temperatures.
7.	Ventilation.
7-A.	Ventilation—Exhaled Air and Diffused Body Heat.
8.	Air Changes—Churches and Theatres.
8-A.	Air Changes—Hospitals.
8-B.	Air Changes—Hotels and Libraries.
8-C.	Air Changes—Schools.
8-D.	Air Changes—Miscellaneous.
9.	Properties of Air.
9-A.	Properties of Air—Measurement of Air Flow.
9-B.	Properties of Air—Measurement of Air Flow (Continued).
10.	Ducts and Flues—Duct and Flue Work.
10-A.	Ducts and Flues—Elbows.
10-B.	Ducts and Flues—Anemometer Readings.
10-C.	Ducts and Flues—Underwriters' Rules.
10-D.	Ducts and Flues—Underwriters' Rules (Continued).
10-E.	Ducts and Flues—Underwriters' Rules (Continued).
10-F.	Ducts and Flues—Duct and Flue Velocities.
10-G.	Ducts and Flues—Vent Flue Velocities.
10-H.	Ducts and Flues—Duct Areas.
10-I.	Ducts and Flues—Duct Areas (Continued).
10-J.	Ducts and Flues—Pipe Capacities at Various Velocities.
10-K.	Ducts and Flues—Weight of Sheet Metal Pipes.
10-L.	Ducts and Flues—Factors to Change Gauge.
10-M.	Ducts and Flues—Sizing, First Method.
10-N.	Ducts and Flues—Sizing, Second Method.
10-O.	Ducts and Flues—Sizing, Third Method.
10-P.	Ducts and Flues—Sizing, Third Method (Continued).
10-Q.	Ducts and Flues—Sizing, Fourth Method.
10-R.	Ducts and Flues—Sizing Fifth Method.
10-S.	Ducts and Flues—Sizing, Fifth Method (Continued).
10-T.	Ducts and Flues—Sizing, Sixth Method.
10-U.	Ducts and Flues—Sizing, Sixth Method (Continued).
10-V.	Ducts and Flues—Sizing, Seventh Method.
10-W.	Ducts and Flues—Sizing, Seventh Method (Continued).
11-A.	Duct and Flue Details—Flue Outlets and Dampers.
11-B.	Duct and Flue Details—Details of Reversing Dampers.
11-C.	Duct and Flue Details—Length of Fan Connection to Heater.
12.	Heating and Ventilating Symbols.
13.	Radiation Computing.
13-A.	Radiation Computing—Efficiencies.
13-C.	Radiation Computing—Example.
14-A.	Radiators—American 1-Col. Rococo.
14-B.	Radiators—American 2-Col. Rococo.
14-C.	Radiators—American 3-Col. Rococo.
14-D.	Radiators—American 4-Col. Rococo.
22-A.	Radiators—Kewanee 1-Col. Ornamental.
22-B.	Radiators—Kewanee 2-Col. Ornamental.
28-G.	Radiators—H. B. Smith Co.'s 1-Col. Princess.
28-H.	Radiators—H. B. Smith Co.'s 2-Col. Princess.
28-I.	Radiators—H. B. Smith Co.'s 3-Col. Princess.
28-J.	Radiators—H. B. Smith Co.'s 5-Col. Princess.
30-A.	Radiators—United States Radiator Corp. 1-Col. Florentine.
30-B.	Radiators—United States Radiator Corp. 2-Col. Florentine.
30-C.	Radiators—United States Radiator Corp. 3-Col. Florentine.
30-D.	Radiators—United States Radiator Corp. 4-Col. Florentine.
49.	Boilers—Boiler Horsepower and Ratios.
49-A.	Boilers—Boiler Horsepower to Engine Horsepower.
100.	Chimneys.
100-A.	Chimneys—Residence.
100-B.	Chimneys—Residence (Continued).
100-C.	Chimneys—Coal and Air per Boiler Horsepower.
100-D.	Chimneys—Draft Loss in Fire and Boiler.
100-E.	Chimneys—Draft Loss, Theoretical and Effectual.
100-F.	Chimneys—Theoretical Draft of Stacks.
100-G.	Chimneys—Friction Loss in Steel Stacks.
100-H.	Chimneys—Friction Loss in Brick Stacks.
100-I.	Chimneys—Summary and Draft Reading.
100-J.	Chimneys—Example for Steel Stack.
100-K.	Chimneys—Costs.
107.	Standard Weight Fittings—Rules for 1915 Flanged Fittings.
107-A.	Standard Weight Fittings—Pipe Flanges and Bolts.
107-B.	Standard Weight Fittings—Elbows and Reducers, Flanged.
107-C.	Standard Weight Fittings—Straight Tees, Crosses and Laterals, Flanged.
107-D.	Standard Weight Fittings—Bull-Head Reducing Tees and Crosses, Flanged.
107-E.	Standard Weight Fittings—Reducing Laterals, Flanged.
107-F.	Standard Weight Fittings—Thickness of Shell.
108.	Extra-Heavy Fittings—Rules for 1915 Flanged Fittings.
108-A.	Extra-Heavy Fittings—Pipe Flanges and Bolts.
108-B.	Extra-Heavy Fittings—Elbows and Reducers, Flanged.
108-C.	Extra-Heavy Fittings—Straight Tees, Crosses and Flanged Laterals.
108-D.	Extra-Heavy Fittings—Bull-Head Reducing Tees and Crosses, Flanged.
108-E.	Extra-Heavy Fittings—Reducing Laterals, Flanged.
128-A.	Flow of Steam in Pipies—Capacity of Steam Mains, ⅛ Lb. Drop.
128-B.	Flow of Steam in Pipes—Capacity of Steam Mains, ¼ Lb. Drop.
128-C.	Flow of Steam in Pipes—Capacity of Steam Mains, ½ Lb. Drop.
128-D.	Flow of Steam in Pipes—Capacity of Steam Mains, 1 Lb. Drop.
128-E.	Flow of Steam in Pipes—Steam Pipe Sizes.
128-F.	Flow of Steam in Pipes—Sizes of Return Mains.
128-G.	Flow of Steam in Pipes—Sizes of Return Mains (Continued).
128-H.	Flow of Steam in Pipes—Drip Pipe Sizes.
129.	One-Pipe Steam Systems—General.
129-A.	One-Pipe Steam Systems—Circuit Mains.
129-B.	One-Pipe Steam Systems—Relief System.
129-C.	One-Pipe Steam Systems—Mills System.

129-D. One-Pipe Steam Systems—Radiator Connections.
129-E. One-Pipe SteamSystems—Radiator Runouts and Main Line Vents.
129-F. One-Pipe Steam Systems—Drop in Pressure and Rise of Return.
129-G. One-Pipe Steam Systems—Pipe Sizes.
129-H. One-Pipe Steam Systems—Riser Sizes.
129-I. One-Pipe Steam Systems—Radiator Connections.
131. Vacuum Heating Systems—General.
131-A. Vacuum Heating Systems—Pipe Sizing.
131-B. Vacuum Heating Systems—Piping Details.
169-E. Exhauster Systems—Weight of Sheet Metal Pipes.
169-F. Exhauster Systems—Factors to Change Gauge.

Extra copies of the sheets published printed on one side only, may be had at 5 cents each. In addition, several series which are now complete, may be had at special prices, as follows:

Set No. 1.—B. T. U. Losses (8 sheets)....	25 cents
Set No. 2.—Computing Heat Losses (6 sheets)	20 cents
Set No. 3.—Air Changes (5 sheets)	15 cents
Set No. 4.—Ducts and Flues (Including seven methods of sizing) (24 sheets)	$1.00
Set No. 5.—Chimneys (13 sheets)	50 cents
Set No. 6.—Fittings (13 sheets).....	50 cents
Set No. 7.—Flow of Steam in Pipes (8 sheets)	25 cents
Set No. 8.—One-Pipe Steam Systems (9 sheets)	30 cents

A binder, designed especially for containing these sheets, suitably stamped and bound in brown duck, is furnished at $1.50.

Those desiring to procure all of the sheets published to date have the privilege of ordering those appearing in any one volume (48 sheets) at $2.00.

The Field of the Smokeless Boiler from the Manufacturers' Point of View.

We believe the agitation relative to the smokeless burning of coal has had a great deal to do with waking the people up to the fact that a large amount of coal has been wasted by its being improperly burned.

The Fuel Administration's restrictions regarding supplies of anthracite coal has started a great many people to using bituminous coal and many of them will never go back to anthracite. In addition to the Fuel Admnistration's operations, the smoke ordinances of the different cities and the activities of the Association for the Prevention of Smoke have also helped greatly to bring out the people's interest in the proper burning of coal.

Where there is perfect combustion there is no smoke and where there is smoke it shows combustion is not right and that fuel is being wasted. The burning of fuel with an excessive amount of smoke shows a great deal of waste which should be eliminated. It has been proved scientifically and practically that the cheaper grades of soft coal can be burned without smoke and manufacturers are now building boilers that eliminate the smoke trouble. We find that to-day the majority of people are looking for the higher grades of heating apparatus, rather than trying to get the cheapest and we believe that business along this line will continue to improve as the people fully realize the importance of burning soft coal economically and without smoke.—*J. B. Bernhard, Kanawha Manufacturing Company.*

Federation of Refrigerating Societies.

The principal societies in the refrigerating industry have formed a federation which will be known as the American Association of Ice and Refrigeration. It is composed of some eleven different organizations.

Deaths.

Edward P. Bates, president of the E. P. Bates Co., Syracuse, and for many years a prominent figure in the heating and ventilating trade, died in Butte, Mont., August 4, of heart disease. In addition to his extensive engineering and contracting business, Mr. Bates found time to interest himself in many association movements for the bettering of the industry. He was in former years a well-known figure at conventions of the Master Steam and Hot Water Fitters' conventions, was a former member of the American Society of Heating and Ventilating Engineers and was a members of the American Society of Mechanical Engineers and of the American Society of Naval Architecture and Marine Engineers.

John Farrell, one of the founders of the Bailey-Farrell Mfg. Co., of Pittsburgh, who died in Pittsurgh, June 28, was for many years a leading figure in the heating and plumbing supply business in that district. He retired from the active management of the company some 16 years ago, so that he was not so well known to the present generation, but among the older element he had a wide acquaintance and many warm friendships. He was born in Ireland in 1835 and came to this country at the age of 9 years. During his almost lifelong residence in Pittsburgh, he was prominent in financial and charitable, as well as in business affairs, holding the positions, among others, of vice-president and trustee of the Dollar Savings Bank of Pittsburgh, director of the National Union Fire Insurance Company and trustee of the Mercy Hospital.

For Permanent Cleaning Equipment

specify the

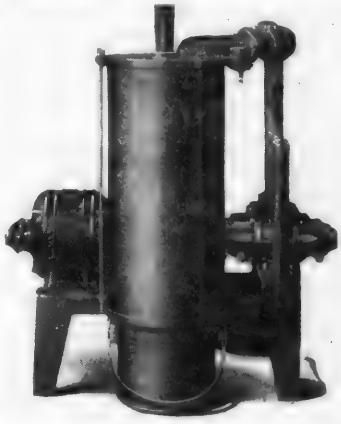
ARCO WAND Vacuum Cleaner!

How a Building is Piped

Showing ARCO WAND Vacuum Cleaner with suction pipe having covered openings or inlets for hose connection in basement, first, and second floors. A strong suction swiftly and silently draws all dirt, fuzzy dust, paper bits, thread, lint, cobwebs, moths, bugs, germs, trash, etc., through the cleaning tool, hose, and pipe down into the sealed dust-bucket at bottom of machine. Above shows "Single Sweeper" ARCO WAND; also made as two sweeper for large buildings.

With the ARCO WAND you can specify cleaning requirements for the *smallest* residence or the *largest* business block. Factories, warehouses, apartments, theatres, churches, clubs, hotels—either new or remodeled buildings. Also made in truck type for cleaning large structures without piping.

Send for catalogs. We will be glad to co-operate and assist to specify ARCO WAND Vacuum Cleaners for buildings of any kind or size.



This cut illustrates type Numbers 341 and 361 ARCO WAND with electric motor direct drive

AMERICAN RADIATOR COMPANY

Sales branches and showrooms in all the large cities

VACUUM HEATING SYSTEMS—Piping Details (continued).

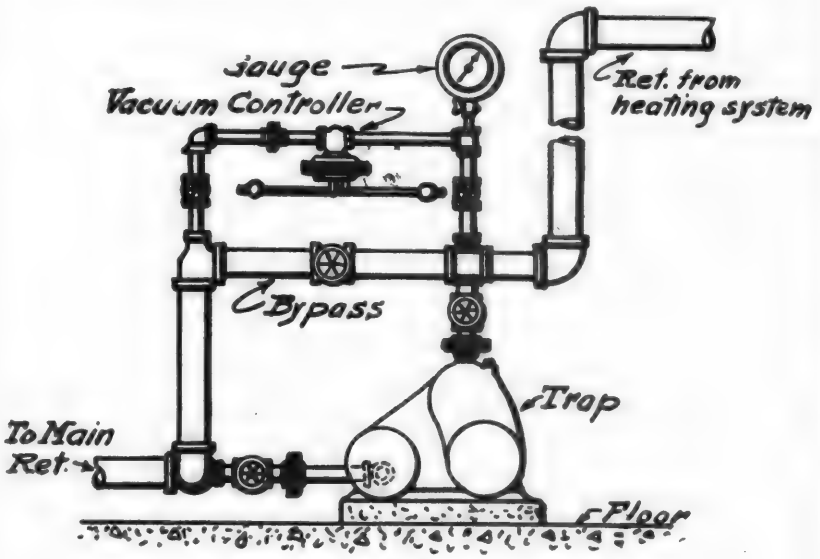


FIG. 5.

Where several buildings are connected to a single return line, some near the vacuum pump and some more remote—or where one building has to employ a lift in the return and another does not—it may prove desirable to control the amount of vacuum carried on each building so as to equalize the effect. Thus the farthest building, or the one employing a lift, may receive the full effect of the vacuum, while the other buildings may be throttled down by means of a vacuum controller so as to have the vacuum applied to the radiators in every building approximately equal.

The vacuum controlled is primarily a combination trap and reversed reducing valve. The trap lets all the condensation pass and operates on the bucket or float principle, but the air and vapor pass through a special air-line by-pass controlled by a weighted diaphragm valve so as to open whenever the vacuum in the building line is too small to close whenever it rises up to the proper degree. Thus the controller automatically permits the removal of water at all times but prevents more vacuum than that desired from reaching the building radiators.

Fig. 5 shows how a typical piping connection for such a vacuum controller can be made.

VACUUM HEATING SYSTEMS—PIPING DETAILS (continued).

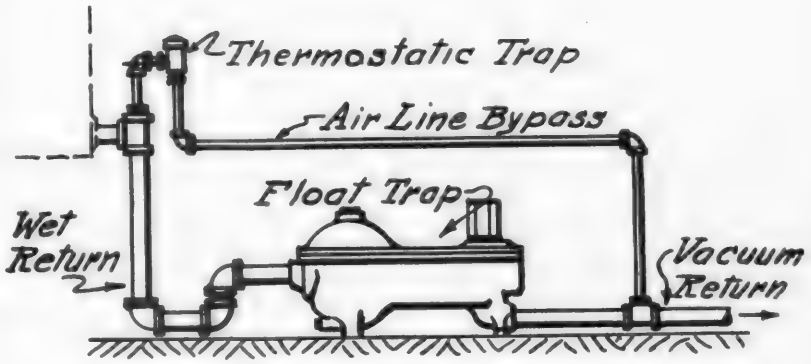


FIG. 6.

Where large quantities of condensation are to be handled, together with comparatively small amounts of air, it is more economical to use a float or bucket trap to handle the water, and an auxiliary themostatic trap to relieve the air. Such conditions are usually found in the draining of large mains and in fan blast heaters. For such cases the scheme shown in Fig. 6 is often used, the thermostatic trap handling what little air comes through the line and the water trap taking care of the condensation; in this way the use of a multitude of thermostatic traps is avoided.

SIZING THE VACUUM PUMP.

The vacuum pump is the heart of the vacuum system and the proper size of pump is often a question upon which an honest disagreement occurs. The simplest solution is the rule of thumb that the cubic displacement of the pump when operated at a reasonable piston speed—say, 80 to 100 ft. per minute—should be not less than ten times the volume of return water to be handled. This rule, however, seems to give smaller capacity pumps than good practice warrants and should be changed to fifteen times the volume.

For instance, a system having 20,000 sq. ft. E. D. R. would condense some $20{,}000 \times \frac{1}{3}$ or 6,666 lbs. of water per hour, which is 111 cu. ft.; this is roughly $111/60 = 1.8$ cu. ft. per minute. Therefore, the pump displacement should be $1.8 \times 15 = 27$ cu. ft. per minute. At 80 ft. per minute piston speed this would mean a cylinder area of $27 \div 80 = 0.34$ sq. ft., or $0.34 \times 144 = 49.16$ sq. in. This is equivalent to an 8-in. diameter cylinder.

The United States Government uses a longer and more complex method evolved by Warren Webster & Co. and which consists of assigning each pump a "factor" rating and then calculating total factors in the system, allowing 100 for each vacuum trap and 1 for each square foot of E. D. R.; thus, for a system with 20 000 sq. ft. of direct radiation and 400 traps, the total factor would be $(400 \times 100) + (20{,}000 \times 1) = 40{,}000 + 20{,}000 = 60{,}000$

The pump schedule is shown in Table I and it will be seen that by this method an 8 in. x 10 in. x 14 in. pump would be required which is quite a little larger than the size obtained by the first method, unless the multiple of 15 is used.

TABLE I.

SINGLE-CYLINDER DOUBLE-ACTING VACUUM-PUMP FACTOR RATINGS.

Size of Pump, Inches	*Factor Rating*
4 x 4 x 5	6830
4 x 4 x 6	7270
4 x 4 x 8	8000
4 x 5 x 5	10680
4 x 5 x 6	11350
4 x 5 x 8	12500
4½ x 5½ x 8	15125
4½ x 6 x 5	15390
4½ x 6 x 7	17215
4½ x 6 x 8	18000
5 x 6 x 10	19390
7 x 7¼ x 10	28250
6 x 7½ x 12	30600
7 x 8 x 10	34410
6 x 8 x 12	36620
6 x 9 x 12	43627
8 x 9¼ x 12	48957
8 x 10 x 12	57220
8 x 10 x 14	60250
10 x 12 x 12	82397
10 x 10 x 16	90713
10 x 14 x 16	122500
12 x 14 x 20	133000
12 x 16 x 16	161270
14 x 16 x 20	173720
16 x 18 x 20	219870
16 x 18 x 14	233640
18 x 20 x 20	271440

VACUUM PUMP CONNECTIONS.

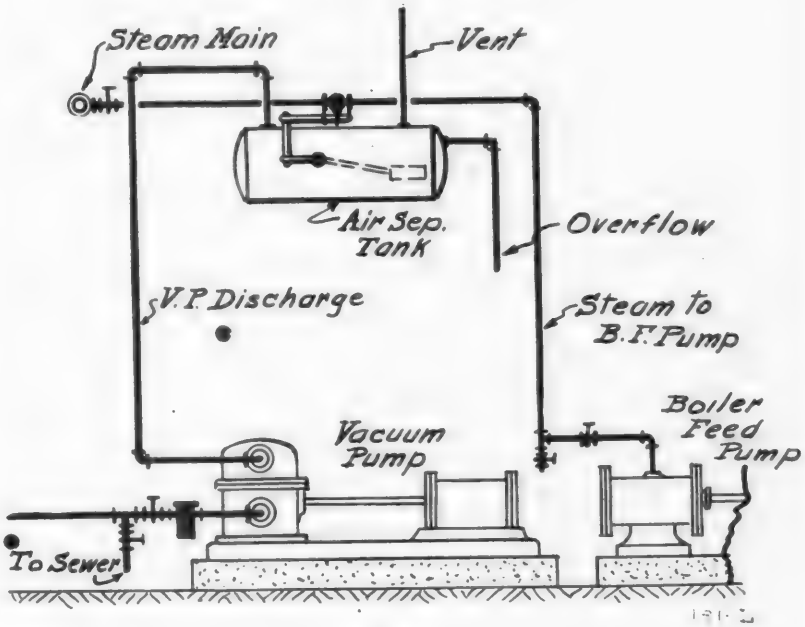
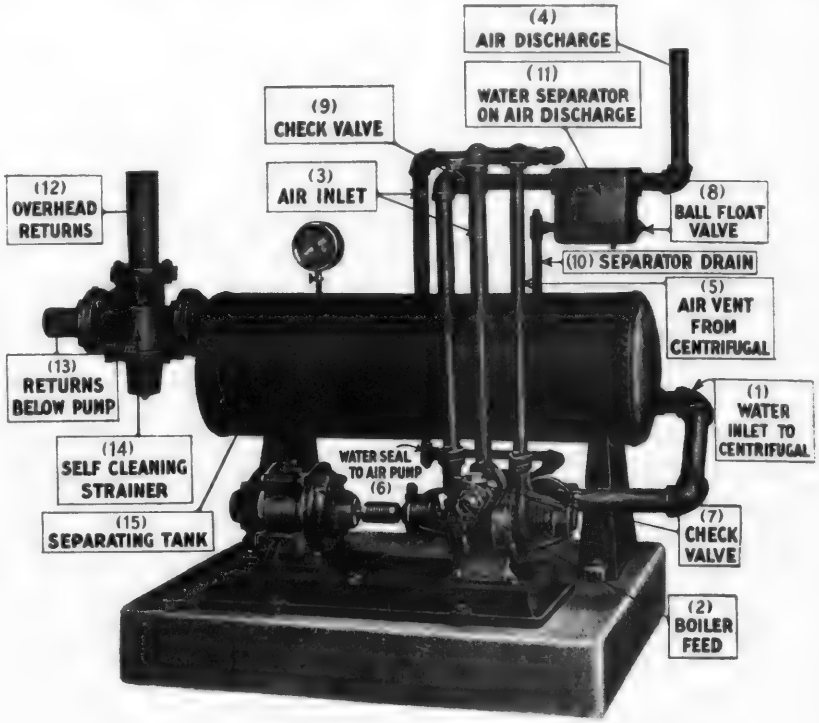


FIG. 1.

It is not necessary or even advisable to use any sort of a receiving tank before a vacuum return enters the vacuum pump suction. The only thing necessary is to install a good strainer close to the pump, with a valve on the building side of the strainer and a bypass connection to the sewer; this is illustrated in Fig. 1. Sometimes a vapor condenser is installed in the return line with cold water inlet and outlet connections, the water circulating through interior tubes and condensing the vapor in the return line. In other instances a little cold water is added to the return itself in order to reduce its temperature to below the vaporizing point. Where such jet water is used it is generally introducd through the strainer which has a special tapping for this purpose.

On the pump discharge the air, vapor and water are driven through a check valve and up into an air separating tank in which a float is located, controlling the return pump which takes its suction from the tank, or else the outlet of the tank is connected to the feed-water heater through a deep water-seal, as shown in Fig. 1. The air passes off through the air vent on the air separating tank.

Efficient Heating
demands the JENNINGS PUMP



Size C for 26,000 square feet radiation, requiring only 2 H. P. Motor at 1,720 R. P. M., when delivering from a vacuum 10 inches mercury against a boiler pressure of 10 lbs.

The Jennings Pump consists of two independent turbine units, an air pump and a water pump, combined in one casing, with the impeller of each mounted on the same shaft.

One unit continuously exhausts air and vapors from the heating system, and the other removes the condensation as it accumulates and forces it directly into the boiler, or up to the hot-well.

The boiler pressure is against the water only. The air and vapor, representing approximately four-fifths of the volume handled, are delivered to the atmosphere *without back pressure. The saving in horse power amounts to over 50 per cent.*

The Pump is bronze fitted throughout. The shaft is tobin bronze. The air rotor, water impeller, lobe, port plate, sealing rings and clamping nuts are bronze. The shaft is supported on high grade annular ball bearings mounted outside of the pump casing.

Write for Bulletin No. 8

NASH ENGINEERING CO.

SO. NORWALK, CONN., U. S. A.

TRADE AND MISCELLANEOUS NOTES

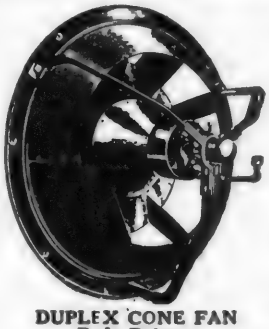
Miscellaneous Notes.

National Safety Council will hold its eighth annual safety congress in Cleveland, O., October 1-4.

International Exposition of Muncipal Equipment, designed to be a permanent exposition, will open in the Grand Central Palace, New York, October 15. It will be conducted by the Merchants and Manufacturers Exchange of New York which is operated and controlled by the Nemours Trading Company, of which Alfred I. du Pont is president.

International Supply Co., Washington, D. C., is being formed, with an authorized capital of $1,000,000, to deal in building materials, largely for export. The manufactured products which the company proposes to handle include heating, plumbing and electrical goods. In its prospectus the organizers state that every great war has been followed by an era of prosperity and adds: "We emerge from the war period with a shortage of structural material of all kinds. Human habitations are lacking to an extent never beore realized. So general is this condition that in many of our cities and towns a suitable house is impossible to obtain. Added to these are the necessities of all other nations. In the devastated districts whole cities must be rebuilt. Among the promotors of the company is Lieut-Col. E. H. Abadie of St. Louis, formerly a general contractor in that city.

National Federation of Construction Industries, in a service letter on "Dangers Arising from the Upward Tendency of Prices," says, among other things: "Higher levels of prices follow higher wages in a vicious circle in which prices always keep in advance of wages. It is the good fortune of the country and to the credit of the construction industry that the prices of building materials and construction in



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Ventilating Engineers and Contractors
MANUFACTURERS OF
BLACKMAN and DUPLEX CONE FANS
which are installed by us complete with Motors, Duct Work and Wiring.

Aligning, Rigging and Hoisting done, with labor thoroughly qualified from long experience.

We make a specialty of Kitchen Exhaust work. Prominent buildings, hospitals, theatres, and private residences are among our many and recent installations.

The Duplex Cone Fans are semi-conoidal fans, made especially to operate against pressure in duct systems.

The Blackman Fans are used for fresh air delivery and in duct systems, when no great pressure is involved.

You can have the advantage of our experience.

SEND FOR CATALOGUE

BLACKMAN FAN
Direct Connected to Motor

Please mention THE HEATING AND VENTILATING MAGAZINE *when you write.*

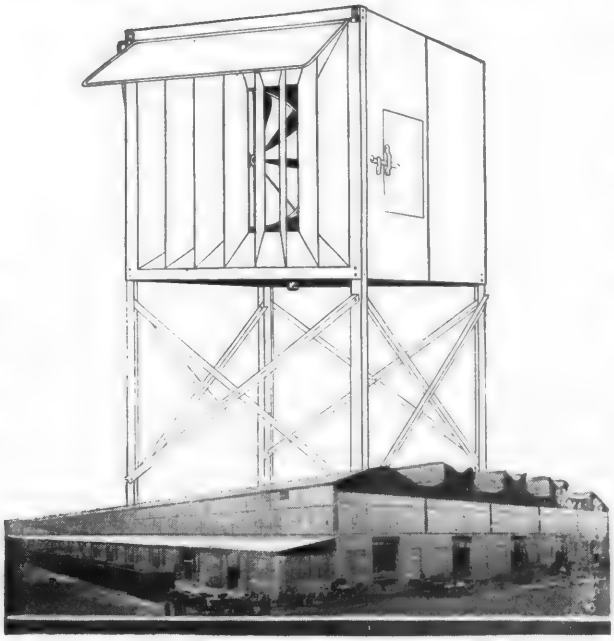
general have increased 23% less than the prices of other commodities. The welfare of this industry depends upon the continued and regular erection of buildings and not upon spasmodic booms. It is thus to the interest of the entire construction industry to maintain the present advantage of price differential in relation to other commodities." A full expression of views of manufacturers is asked as to ways and means of bringing about a decrease in the cost of general commodities. Every effort, it is stated, will be made by the Federation to promote a sound state of health in industry by encouraging the increase of production without increasing prices.

Illinois Manufacturers' Association held a national "Our Country First" conference in Chicago, September 8-9, to discuss the causes of national unrest, with a view of presenting to Congress the sentiments of the business world "in order that fair and honest legislation may be enacted, a square deal given to all, and the nation freed of the agitators who are trying to overthrow the very foundations of our government."

H. A. Austin, formerly with the New York Steam Company, New York, is now connected with the General Motors Company, supervising the erection of a large office building for the company in Detroit.

ILGAIR UNIT HEATERS

NOW USED BY MANY OF AMERICA'S INDUSTRIES EVERYWHERE



AMAZINGLY EFFICIENT FOR HEATING IN WINTER AND COOLING IN SUMMER

RD EAGLE PLANT, DETROIT, MICH.

The above immense industrial plant—the largest of its kind—required abundance of heat. It was economically secured with 60 "ILGAIR" Unit Heaters.

Write for literature describing this outfit and illustrating many important installations.

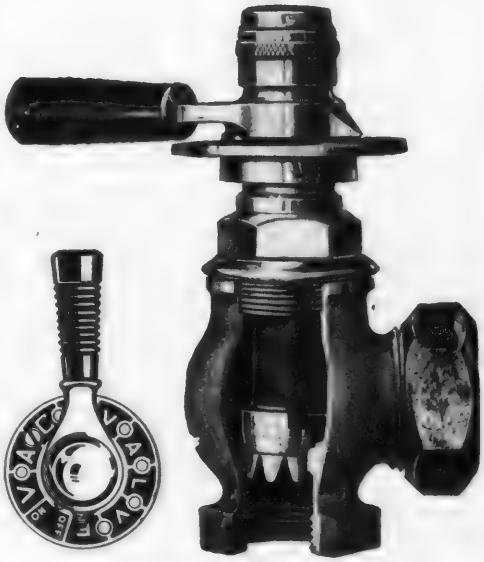
ILG ELECTRIC VENTILATING CO.
158 Whiting St. CHICAGO, ILL.
Branches in all Large Cities

HIGH EFFICIENCY TRADE ILG MARK VENTILATING MACHINERY

DETROIT PACKLESS RADIATOR VALVES

The Correct Radiator Valve for Vapor Heating

The Detroit Packless Vacu Valve is a Graduated Valve for Vapor and Vacuum Systems of Heating. The dial plate is provided with a series of holes and a movable pin. This pin acts as a stop for the handle pointer, and is inserted in the hole in the dial nearest the point at which the valve, when opened, admits only sufficient vapor or steam to fully supply the radiator.



DETROIT PACKLESS
Vacu Valve Showing Dial Plate and Lever Handle

Booklet VP-1 Gladly Sent Upon Request

DETROIT LUBRICATOR COMPANY
DETROIT, U. S. A.

LARGEST MANUFACTURERS OF RADIATOR VALVES IN THE WORLD

Ohio Chapter of the heating engineers' society in Cleveland and the Cleveland Association of Heating and Piping Contractors held a joint outing at Chippewa Lake, about 40 miles south of Cleveland, August 1. The outing was attended by some 75 members of both organizations, accompanied by their families and friends. The day was taken up with outdoor sports, including a tug-of-war and a baseball match. The joint committee in charge was (for the contractors) Henry Henrichsen, chairman; M. Jones, Robert Rowe, E. Credicott and E. Bohunek, and (for the heating engineers) J. J. Mason, chairman; F. H. Valentine, secretary; I. B. Coe, M. L. Foote, J. H. Bacon, A. E. Tomlinson and E. F. Bohm, who acted as secretary of the joint committee.

Building Permits for July, as reported by the *American Contractor*, of Chicago, show an increase of 288% over the same period in 1918, the figures being $130,746,609 as compared with $39,850,626 for July, 1918. The average value of permits for July is $3760. This is a higher figure than for previous months, indicating that repairs are not figuring to the extent they did in former reports. The figures for Chicago are $7,714,700; Cleveland, $5,165,075; De-

PIPE BENDING

MARINE EQUIPMENT AND REPAIR WORK
HEATING AND VENTILATING

THE OHIO HEATING AND PIPE BENDING CO.

Main Office and Factory, 1061-63 West 11th Street, Cleveland, Ohio

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F. J. Nice Oil and Combination Oil and Gas Burners

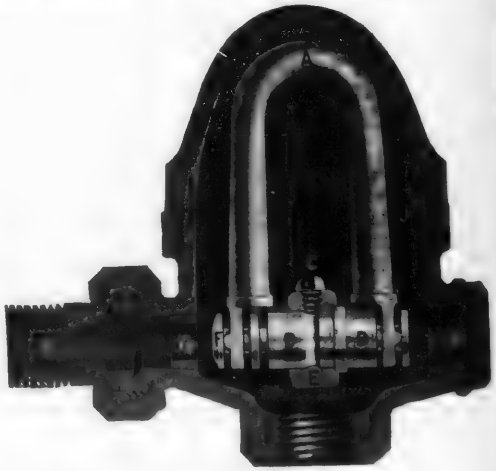
Built to Overcome Scale and Foreign Matter

The valve mechanism in all

HAINES
Automatic
VALVES and TRAPS

is mounted horizontally, causing scale and foreign matter to drop clear of the seat and valve at each operation.

Guaranteed absolutely for a period of five years, when used on vacuum or low-pressure heating systems.



HAINES VENTO TRAP
Recommended for use with cast iron radiation with low pressure steam. Not exceeding 10lbs.

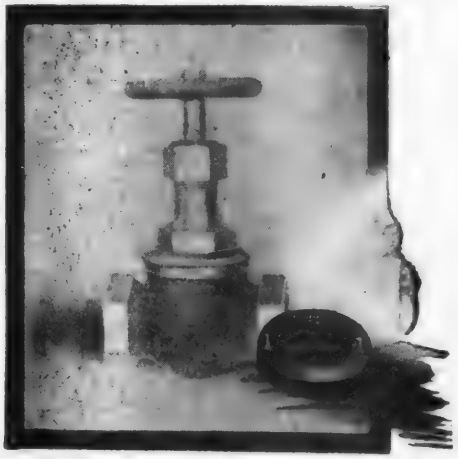
Send for latest catalogue

WM. S. HAINES & CO., Philadelphia, Pa.

troit, $8,079,965; Fort Worth, $2,047,995; New York: (Brooklyn) $6,958,805; (Manhattan) $7,026,780; (Richmond) $385,647; (Bronx) $2,771,420; (Queens) $7,123,396; Philadelphia, $6,693,785; Pittsburgh, $1,362,049; Rochester, $1,193,356; Sioux City, $1,372,275; St. Louis, $3,302,537; St. Paul, $1,652,436; Tulsa, Okla., $1,161,625.

July Building Operations, reported by the F. W. Dodge Co., New York, containing comparative statistics of building and engineering operations from January 1 to August 1, based upon contracts awarded, show that building activities are now on a scale that compares favorably with any other previous period. For instance, comparative statistics in the State north of the Ohio and east of the Missouri Rivers, including New England, New York, New Jersey, Pennsylvania, Maryland, Delaware, District of Columbia, Virginia, Ohio, West Virginia, Illinois, Indiana, Iowa, Wisconson, Michigan, Minnesota, North and South Dakota and portions of Missouri and eastern Kansas, make the following showing:

Contracts Awarded.	Value.
Jan. 1 to Aug. 1, 1919	$1,298,228,000
" " " " " 1918	1,064,688,000



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Specially made for each specific use

Jenkins Renewable Composition Discs are made of several compounds, each of which is best suited for some particular service and guaranteed for that service.

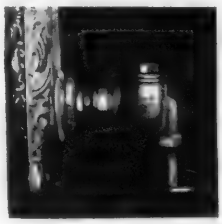
The materials used in the manufacture of the discs are the best obtainable and those which scientific research and actual use have demonstrated, give satisfaction and maximum service.

Genuine Jenkins Renewable Composition discs have been made for over 50 years—know them by the Jenkins "Diamond Mark."

JENKINS BROS.

New York Chicago Boston Philadelphia Montreal London

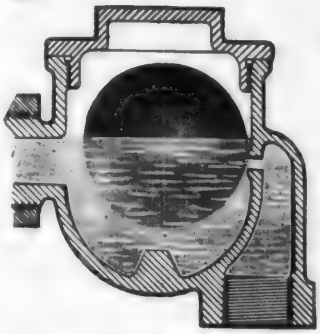
Jenkins Valves



A hollow sphere

Made of copper and free to float—about 60% submerged.

against the submerged outlet



Blocks the flow of steam but allows water to pass when the water itself rolls the ball up.

THE hollow sphere in the *Johns-Manville Radiator Trap* has nothing to do but float—away from or over the outlet—depending on whether or not there is water to be discharged.

But it always holds back the steam, regardless of pressure or heat. And because the Johns-Manville Radiator Trap operates positively, regardless of temperature—there are no adjustments to make, either before or after installation.

This simplicity saves work for you, insures easy operation and the minimum of wear.

H. W. JOHNS-MANVILLE CO.

New York City

10 *Factories—Branches in 63 Large Cities*

Through—

Asbestos

and its allied products

JOHNS-MANVILLE Service in Construction

Heat Insulations, High Temperature Cements, Asbestos Roofings, Packings, Brake Linings, Fire Prevention Products

JOHNS MANVILLE

Radiator Trap

" " " " "	1917	990,602,000
" " " " "	1916	711,005,246
" " " " "	1915	508,233,600
" " " " "	1914	454,579,300
" " " " "	1913	545,067,500
" " " " "	1912	482,577,500
" " " " "	1911	477,227,313
" " " " "	1910	526,425,460

In New England alone the activity is only a little below the highest point, reached in 1916. In New York and northern New Jersey it is beyond the highest previous point. In Philadelphia, Baltimore and Washington the figures show that only in 1918 was there more activity than at present. This is also true of Pittsburgh. In the Central West the figures are far beyond anything heretofore known, while in the Northwest they are still below those of 1915, 1916 and 1917.

William G. R. Braemer, Philadelphia, Pa., specialist in air conditioning and drying, has been retained as consulting engineer by the Department of Agriculture to design the air conditioning equipment for the Experimental Greenhouse Laboratory of the Department of Agriculture. This plant will provide for maintaining any temperature from 40° to 110° F. and any dewpoint temperature from 40° to 90° F., at all seasons of the year, regardless of outdoor conditions.

Manufacturers' Notes.

United Vacuum Appliance Co., Connersville, Ind., manufacturer of the Connersville line of stationary vacuum cleaners, announces the sale of its entire vacuum cleaner business to Landers, Frary & Clark, of New Britain, Conn. The manufacture and sale of the Connersville vacuum cleaners will be continued in Connersville as the United Vacuum Appliance Division of Landers, Frary & Clark, under the management of E. H. Glass and Joseph M. Wilkin.

J. L. Mott Iron Works, New York, manufacturers of heating and plumbing goods, has leased the property and buildings at Broadway and Hopkins Ave., Long Island City, for a term of years.

Monash-Younker Co., Chicago, Ill., whose rights in the manufacture of Monash valves and pump governors were sold recently to the Harrison Safety Boiler Works, of Philadelphia, will continue to manufacture

Try a Sarco Temperature Control at Our Expense

It won't cost you a cent to see for yourself how much *more dependable* service you can get out of a Sarco Temperature Control than you can get out of the usual Temperature Control.

Sarco is entirely self-contained and self-operated. Requires no electricity, compressed air or other outside agencies. Has no complicated connections or attachments. Is operated by the expansion and contraction of a sensitive but dependable oil that controls the valve.

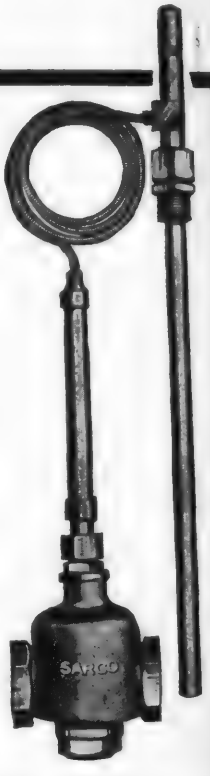
Costs less than others to start with. Costs less to install. Costs nothing for up-keep. Has no rubber or leather diaphragms or other perishable parts.

The action of the Sarco is so positive and dependable that it gives entire satisfaction when used for the most delicate manufacturing processes as well as for room temperature control. Suitable for operating steam, water or gas valves.

You can lose nothing by trying out this compact, efficient Temperature Control *free of charge.*

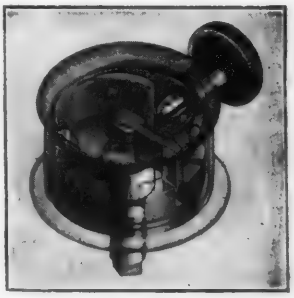
Write us today for Booklet P-51 and full particulars of regulators for either tank or room temperature.

SARCO COMPANY, INC., 231 Broadway, N. Y. City
Ellicott Square, Buffalo — Majestic Bldg., Detroit
Monadnock Block, Chicago — Drexel Bldg., Philadelphia
Peacock Bros., Montreal



Solve the Problem of Damper Regulation Room Indication and Control

The Perfecto
Damper Regulator and Indicator



for regulating the supply of hot and tempered air in heating and ventilating systems.

Absolutely Prevents Tampering by Unauthorized Persons

May be placed on the wall of a room where the ventilating ducts are concealed within the wall and the damper connected to it by an extension of the square damper rod. Especially useful in schoolrooms, **libraries, public** and **government buildings.**

Send for further particulars

THE SIXTH CITY SHEET METAL WORKS CO., Cleveland, O.
Galvanized Iron Work for Heating and Ventilating Systems

TEMPERATURE CONTROLLING APPARATUS

The Basic Principle is RIGHT

Powers Regulators are built with quality-thought first. They are built on a principle which thirty years of use have proved to be basically right.

A Powers Regulator is made for every ordinary condition or process where automatic temperature control is desirable. Adaptations may be made for out-of-the-ordinary conditions without in any way affecting the efficiency of the Regulator.

Our Bulletins give concise, accurate information respecting Powers Regulators. They are free for the asking.

Our more than thirty years' devotion to the problems of temperature regulation exclusively has brought a vast fund of experience, which is at your service.

The Powers Regulator Co. *Specialists in Automatic Heat Control* — 954 Architects Bldg., New York; 2143 Mallers Bldg., Chicago; 365 The Federal Street Bldg., Boston

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It's a Pleasure to Work

in an office where the air is as sweet as a balmy summer breeze.

Five floors like this in the large General Office Building of Swift & Co., Union Stock Yards, Chicago, are supplied with air passed through a

WEBSTER AIR WASHER

and in winter, not only the heat is ideal but the proper percentage of humidity is maintained, while in summer the air is kept many degrees lower than street temperature.

Send for reprint of article telling all about this wonderful installation.

ATMOSPHERIC
CONDITIONING CORPORATION
LAFAYETTE BUILDING
PHILADELPHIA

the Monash line of air valves and return valves for vacuum heating systems.

Scientific Heater Co., Clveeland, O., manufacturer of gas heaters, including house-heating apparatus, has consolidated with the Economy Stove Co., of that city. Larger quarters have been taken at 2100-2124 Superior Viaduct. The company's line will include gas and combination stoves and ranges, clothes dryers, warm-air furnaces and garage heaters.

Casey-Hedges Co., Chattanooga, Tenn., will build a new machine shop, 65 x 200 ft., to cost $40,000, including equipment, for the manufacture of its line of boilers and other heating apparatus.

American Radiator Co., Chicago, Ill., has declared a quarterly dividend of 4% on its common stock, payable September 30, and 1¾% on its preferred stock, payable August 15.

Crane Co., Chicago, is building a four-story warehouse, 90 x 200 ft., at 1996 Park Ave., New York, to cost $175,000. The White Construction Co., of New York, has the contract.

Central Station Steam Co., Detroit, Mich., manufacturers of central station heating

Opens the Damper and Closes the Check

The "Little Draft-Man"

Furnace Regulator

A SIMPLE mechanical device that has a wonderful appeal to all who heat their homes with furnaces. With no more trouble than to set the clock at night, the "Little Draft-Man" opens the damper, closes the check, and starts the fire burning briskly. Enables the family to get up in a warm house without the bother of going near the furnace. Turn the "ON" or "OFF" handle to start or check the flow of heat any time of day. Goes on new or old furnaces of any make. Can be installed by anybody in a few moments. Dealers will find this regulator a quick seller. Retails at $15. Liberal discounts to dealers. Send for descriptive folder and details of our proposition.

Sahlin Manufacturing Company
36 Ottawa Ave., N. W.
Grand Rapids, Michigan

A NOTEWORTHY feature of the equipment of the First National Bank Building, Milwaukee, Wis.—illustrated below—in common with other similar structures throughout the country, is its "Sirocco" System of Ventilation, assuring a constant supply of pure, fresh air to every tenant. This, however, is but one detail in the general plan of its owners, their theory being that the more healthful the conditions and the greater the measure of service and convenience offered to tenants, the greater the demand for office space. The architects were D. H. Burnham & Company, Chicago.

"SIROCCO"
:: SYSTEM *of* ::
VENTILATION

is consistently selected for duty in buildings of the better and more costly type. "Sirocco" equipment is specified by the architect strictly on its merits, because it can be depended upon to function perfectly at all times at a minimum cost for upkeep and repairs.

Architects and engineers have at their command the assistance of the engineers of our various branch offices. You are invited to avail yourself of their services on your next construction problem.

AMERICAN BLOWER CO.

DETROIT, MICHIGAN

CANADIAN SIROCCO CO., Ltd.
Windsor, Ont.

Branches in All Large Cities

"Sirocco" TRADE MARK

equipment and supplies, announces the opening of a branch office in Chicago, Ill., at 902 First National Bank Building, with A. K. Abernethy in charge. Mr. Abernethy was formerly manager of the company's Minneapolis office. All business in Illinois, Iowa, Nebraska, Missouri, Indiana and Ohio will be handled from the Chicago branch.

American Radiator Co., Chicago, Ill., will establish a distributing center in New Haven, Conn., and is building a large warehouse, one of the largest of its kind in the city, on South Front St., near Ferry St. Carey & Larkin have the contract for the construction of the building. The company is also buildig a plant in Laurel Hill, Long Island, which will be six stories high. It will be located on property acquired on Newton Creek, and on an adjoining plot on the Laurel Hill Boulevard. The purchase price is said to be $140,000.

McAlear Mfg. Co., Chicago, Ill., has moved to the company's new factory at 1901-1907 South Western Avenue, Chicago, where the manufacture of the McAlear line of power and heating specialties will be continued. The new plant is equipped with the most modern machine tools. The company manufactures a complete line of vacuum and vapor heating specialties, including packless radiator valves and steam specialties for power and heating work. A few years ago the company, under the direction of Mr. McAlear, started out in a small way to manufacture and develop specialties for power and heating work, the purpose being to maintain a high grade of quality at the lowest reasonable price. These principles have been carried out with such success that the company's products are recognized and accepted as measuring up to a high standard.

Illinois Malleable Iron Co., Chicago, Ill., will build a $500,000 malleable iron foundry in Louisville, Ky., to occupy a site comprising 40 acres belonging to the Merhoeff estate, at the intersection of Ash Bottom Road and Southern Railway tracks. Operations, it is expected, will be started by December 1. The new plant will employ 500 operatives. The Illinois Malleable Iron Company is capitalized at $2,500,000 and has a plant in Chicago and branch plants in other cities.

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., has resumed its home-building program that was postponed during the war. The company now has 48

Manufacturers of Weather
Humidification,
Dehumidification,
Heating, Cooling
Ventilation, Purification,
Drying

The Mechanical Weather Man says

"About the only thing most modern businesses have considered beyond control, is

WEATHER

But more than two hundred distinctly different American Industries, from chewing gum to aeroplanes, *are* controlling the weather, by ***manufacturing*** their own weather, inside their own plants, thus controlling every factor which enters into the production of their products.

My apparatus is supplying more than four hundred million pounds of made-to-order weather every working day.

Is there a place for Manufactured Weather in *your* business?

Write right now! Ask me for Bulletin, 100-V It's gratis.

Carrier Engineering Corporation

39 Cortlandt St., New York, N. Y.

BOSTON BUFFALO PHILADELPHIA CHICAGO

Buffalo Equipped

THE prominent buildings in all parts of the country are equipped with

Buffalo Heating and Ventilating Apparatus

It puts heat, mechanically, just where it is wanted, keeps it in circulation and prevents it from escaping through the ventilators in in the roof until it has been used to the best advantage. Saves coal—increases efficiency of workers.

Catalog No. 198-36 gives valuable engineering data on heating and ventilating problems and our engineering department is always available for consultation.

Buffalo Forge Company
Buffalo, N. Y.
Offices in all Principal Cities

"Buffalo"

houses under construction. The new houses are being built on a plot of 109 acres owned by the company, along Ardmore Boulevard, in Wilkins township. The new houses will form part of the general building plan for developing the entire tract, to house some 600 families. The company is one of the pioneers in building homes for its employees, having constructed 72 homes near the Trafford foundry almost ten years ago, as well as owning 127 apartments and homes in Trafford proper. T. P. Gaylord, vice-president of the company, is in charge of the building program.

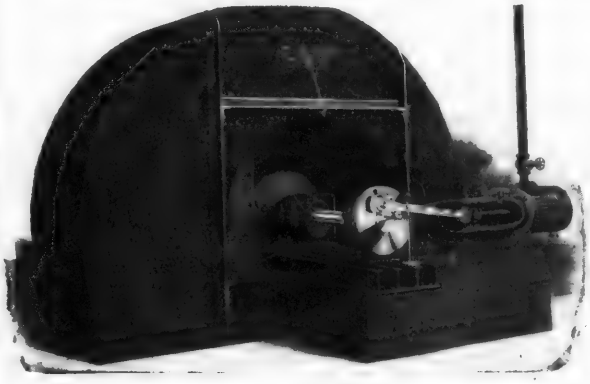
Central Station Heating Notes.

Colorado Springs, Colo.—About 50 downtown business houses and stores will find themselves without heat this winter unless the Pikes Peak Consolidated Fuel Company decides to take over and operate the plant owned by the Colorado Springs Light, Heat & Power Company. The Pikes Peak Company, together with the Stark-Corley Coal Company, had tentatively agreed to operate the plant on a cost basis this winter, provided enough heat consumers would make contracts for the service. The result of a recent canvass among the consumers showed that users of only 9,000,000 lbs. of steam have agreed to continue their patronage of the plant this winter, out of a total poundage used last winter of 45,000,000 lbs. The Stark-Corley has already declined to take over the plant on the report submitted. It is considered, however, that it is almost imperative that the plant be operated, as the time before cold weather is too short for the installation of independent heating systems.

Springfield, Ill.—A further hearing was held July 17 before Examiner Charles M. Tinney, of the Illinois Public Utilities Commission in the matter of the steam heating rates in Peoria of the Central Illinois Light Company. A temporary increase in rates was granted the company last year, with no date fixed for their termination, and the examination was for the purpose of ascertaining whether the increased rates are just and reasonable. The objectors were not represented.

Belvidere, Ill.—The Illinois Public Utilities Company has been authorized to discontinue the operation of three of the mains of its heating system in Belvidere. The company had already been authorized to discontinue the Belvidere heating plant on

Heating Ventilation
Drying Air Washers
Engines Mechanical Draft



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Get Catalogues 65-B and 67-B

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NEW YORK BLOWER COMPANY

MAIN OFFICE:
513 Transportation Bldg., 608 S. Dearborn St., Chicago, Ill.
Toledo, O.: Room 629 Nicholas Bldg.

WORKS:
Bucyrus, Ohio

THE UNIT HEATER

was first placed in use in 1870 by B. F. Sturtevant, founder of the B. F. STURTEVANT COMPANY. Since that time, through careful study and engineering pratice, the present day Portable Unit Heater has been perfected. It is just one of the large and growing family of

Sturtevant
(REG. U. S. PAT. OFF.)

Independent Unit Heater

Its relation to the heating of shops and factories is similar to replacement of the old line shafting, by the unit motor drive.

It eliminates expensive, cumbersome overhead piping; it warms just the portion you wish heated; the exhaust steam from the small turbine, driving the disc or propeller fan, heats the steam coils. Its economy is apparent, and its efficiency has been proven.

The following are typical users:

HYDRAULIC PRESSED STEEL CO. CLEVELAND WINDOW GLASS CO.
AMERICAN LOCOMOTIVE CO. (5 plants) SCOVILLE MFG. CO.
BATES MACHINE CO. MERRILL SILK CO.

Our Engineering Staff, with the benefit of this fifty years of experience is at your service. Estimates given without obligation.

B. F. STURTEVANT COMPANY

Hyde Park, Boston, Mass., U. S. A.

AND ALL PRINCIPAL CITIES

June 1, 1920, but claimed that the operation of the utility has been and in the year 1919-1920 will continue to be a source of loss to the company and that it should, therefore be permitted to abandon certain of its mains at this time.

Spokane, Wash.—The contract for heating the city hall and furnishing hot water for the building for the year ending July 22, 1920, has been awarded to the Spokane Central Heating Company, at its bid of 77¼ cents per 1,000 lbs., with the maximum for the year not to exceed $7,800.00. This rate is the same as the city paid last year, with the additional cost of coal added.

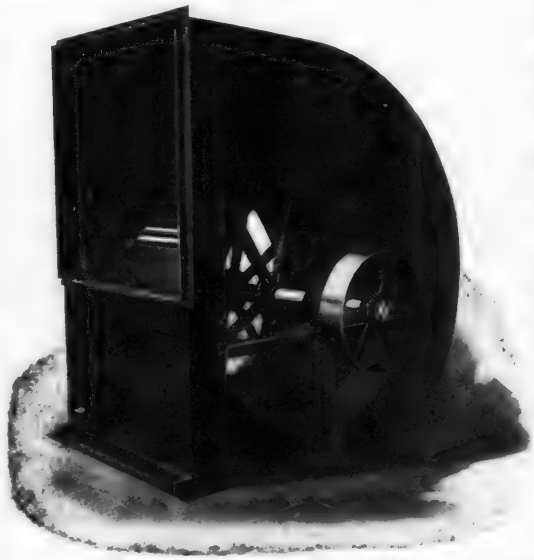
Traer, Ia.—As the result of a special election in Traer, Ia., on the proposition of municipal ownership of the local lighting and heating plant, the vote was overwhelmingly in favor of such ownership. It is probable that the city will take over the equipment of the Iowa Railway & Light Company in Traer and remodel the plant. This applies also to the city heating system. It is expected that the change in management will be effected before Fall.

Bloomington, Ill.—Objection to the rate scale of steam heat of the Bloomington & Normal Railway & Light Company has been made by 80 patrons of the service, including many of the leading firms and owners of down-town business blocks. Their petition was the subject of a recent hearing before Frank G. Ewald, chief engineer of the public utilities commission. An audit of the company's books has been completed by the accounting staff of the utilities commission. In the petition filed by the objectors it was declared that "the rate scale established by the State commission and put in operation in Bloomington is so extortionate in the case of single-store buildings as to make the bills for the past extra-mild winter double or treble what they should have been, and for future cold winters, economically impossible of consideration."

Mattoon, Ill.—According to a decision of the State Public Utilities Commission, the Central Illinois Public Service Company will not be obliged to operate its central heating plant during the summer months. The heating service was desired in summer by the Mattoon patrons for heating the water tanks. The commission found it to be the general practice in Illionis to close down the heating system from May 1 to September 1, while the shut-down was needed to drain the steam pipes and make needed repairs. It also found that the company in operating the plant in summer

Buckeye Multiblade Fans

are made especially for low pressure Heating and Ventilating work. They are giving perfect satisfaction.



CORRECT DESIGN. HEAVY CONSTRUCTION, NOISELESS OPERATION, WORKMANLIKE FINISH, HIGHEST EFFICIENCY.

Our Engineering Department is maintained for the purpose of assisting Engineers, Architects, etc., in planning efficient Heating and Ventilating Systems for all buildings.

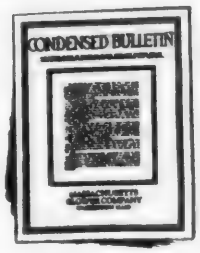
THIS DEPARTMENT IS FREE TO YOU.

We also manufacture a complete line of Disc, Cone and Steel Plate Fans.

Write us

BUCKEYE BLOWER CO.

COLUMBUS, OHIO.



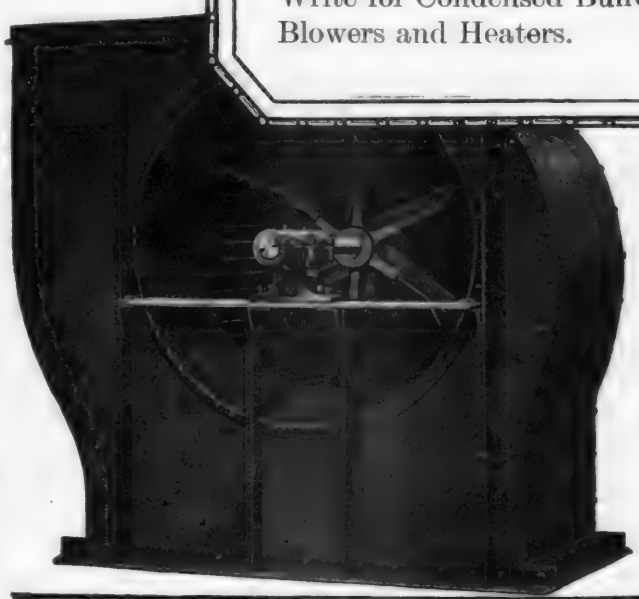
Write for copy—sent for the asking

853,150 Cubic Feet of Air Moved per Minute

By the seventeen Massachusetts Modified Squirrel Cage Fans that make up the ventilating equipment of the Hotel Commodore, New York.

This type of fan, with its saving in space and weight, has been the solution of many a ventilating problem.

Our Engineering Department will be glad to place at your service the statistics and data we have compiled. Write for Condensed Bulletin of Fans, Blowers and Heaters.



MASSACHUSETTS BLOWER COMPANY

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Branches in twenty principal cities throughout the country

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is put to an expense greater than the revenue derived, and in case the consumers would pay the cost of operating in summer, the cost of operating would be so high that the consumers would soon quit using the service. It was pointed out that hot-water tanks can readily be heated by some other method, and at a lower cost.

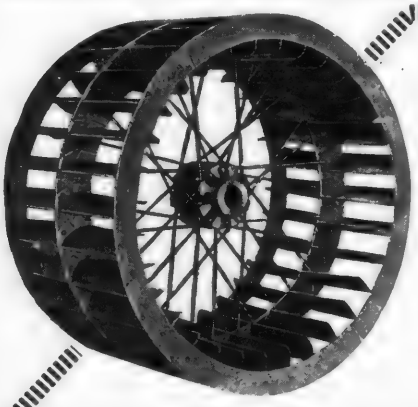
Carroll, Ia.—According to an ordinance passed by the city council of Carroll, the long-fought battle between the Iowa Light, Heat & Power Company and the city council over the heat rate schedule, has been settled in favor of the company. The new schedule will be based on a "sliding scale," by which the heating rates will be automatically advanced or lowered with the rise or fall in the price of coal. It is provided that the council or any citizen may have full access to the figures in such cases. The most important item, around which the main fight was centered, was with reference to making an overcharge to customers who have insufficient radiation in their homes and business houses. The company is now empowered to overcharge its underset customers in proportion to the amount of radiation lacking in their premises. Customers who have insufficient radiation are given two years to install sufficient heating surface. The new schedule will not be retroactive, although this was the agreement between the city council and the heating company last winter. This point was eliminated by the new ordinance and the new schedule will go into effect with the opening of the heating season October 1. It is expected that when conditions are adjusted on the new basis, the capacity of the heating plant will have been actually increased by at least 20%.

New Incorporations.

Memphis Weather Strip & Screen Co., Memphis, Tenn., capital $10,000, to manufacture metal weather strips, wire screens, etc. Incorporators: J. M. Walker and others.

Eichenbaum Supply Co., New York, capital $30,000, to deal in heating, plumbing and sheet metal supplies. Incorporators: J. Eichenbaum, S. E. Blackman and E. Eichenbaum, all of New York.

State Supply Co., Boston, Mass., capital $50,000, to deal in heating and plumbing supplies. Incorporators: George W. Ravin, Winthrop; Harry Blacklow; Roxbury; Samuel M. Harris, Brighton; Samuel L. Karp, Chelsea; and Louis Ravin, Lynn.



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for Heating and Ventilation

Top-notch efficiency in heating and ventilating equipment is realized in Bayley Plexiform Fans and Chinook Heaters.

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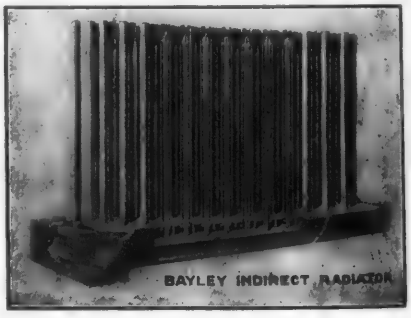
BAYLEY PLEXIFORM FANS are strong, light, highly efficient, quiet in operation and deliver maximum quantity of air from minimum of housing. Equally well suited to high and low pressures. Furnished in both double and single widths.

CHINOOK HEATERS provide for rapid and positive circulation of steam with no danger of short circuiting, and no unequal expansion and contraction. Every square foot is prime heating surface.



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BAYLEY MANUFACTURING CO., 732 Greenbush St., Milwaukee, Wis.

Manufacturers of Heating, Ventilating, Drying and Blower Systems

Westinghouse

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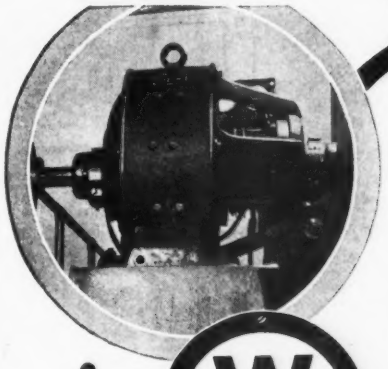

In 1912, eight Westinghouse Type SK direct current motors were installed in the Ritz Carlton Hotel to drive the blowers ventilating the kitchen.

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Although these motors have been in operation from early morning till late at night, every day during the last seven years, the original brushes are still in use.

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WESTINGHOUSE ELECTRIC

Ritz-Carlton Hotel
New York City: Warren & Wetmore, Architects; Clark, Mac-Millen & Riley, Consulting Engineers.

Hunter Heating Co., Baltimore, Md., capital $50,000, to manufacture heating apparatus. Incorporators: Albert C. Putts, William Ewin Bonn and Robert S. Mooney. The company has opened offices at 510 Equitable Building.

National Plumbing & Heating Co., Shreveport, La. Incorporators: Henry Cahn, Abry S. Cahn and Earl C. Schavey.

New Firms and Business Changes.

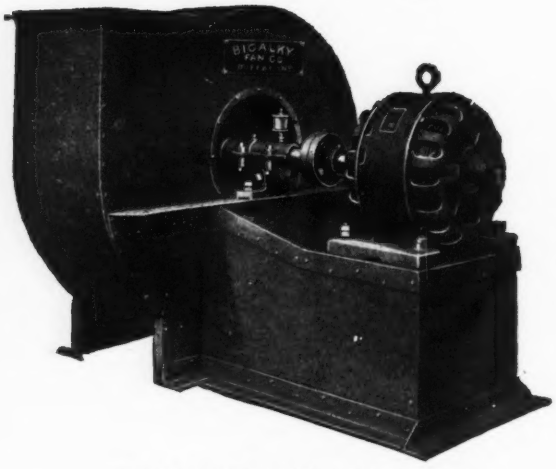
Offner & McKnight, 1270 Broadway, New York, is the title of a new firm of consulting engineers, composed of Alfred J. Offner and James D. McKnight. The firm will specialize on power, heating and ventilating work.

M. A. Dame & Son Co., Lynn, Mass., consulting and contracting engineers, has elected A. A. Klonower vice-president and general manager of the firm. Mr. Klonower has been in charge, during the past two years, of the heating and mechanical design for the Bureau of Yards and Docks, in Washington, having had direct supervision of the design of the heating and power equipment for the Navy Department's large training camps at Hampton Roads, Va. and Coddington Point, R. I. Mr. Klonower's headquarters will be in Lynn. M. A. Dame & Son Company are now completing the contract at Hampton Roads for heating the East Camp Barracks, the heating work alone amounting to over $1,000,000.

M. J. O'Fallon Supply Co., Denver, Colo., has purchased the business of Beeman-Ayer Supply Co., of Albuquerque, N. M. The business will be consolidated with the O'Fallon company, which is building a branch warehouse and office building at 501 North First St., Albuquerque. The Beeman-Ayer Supply Company was established about ten years ago. The O'Fallon branch will now become one of the largest wholesale institutions in the State, his new quarters containing 10,000 sq. ft. of floor space.

Dantzig, Pfeiffer & Ritt, New York, consulting mathematicians, have established offices at 500 West 116th St., New York, to handle problems arising in industry for the solution of which the knowledge of a mathematicial specialist is required. Dr. Dantzig is a graduate of the University of Paris and has taught at Indiana University and at Columbia. During the war he was in charge of the mathematical work of the instrument section of the U. S. Ordnance

BI-CAL-KY



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Department. Dr. Pfeiffer is a graduate of Stevens Institute and has taught mathematics at Harvard, Princeton and Columbia. Dr. Ritt was for three years at the Naval Observatory. During the war he was one of the chief ballisticians in the Ordnance Department.

WANTED.

Wanted—A young man experienced in estimating, designing and selling steam, vapor and water heating apparatus. State experience, age and salary expected. Address Wentworth, care of Heating and Ventilating Magazine.

Wanted—Several good plumbing design men and draftsmen for plumbing layouts on large factories and offices. Address Division Superintendent, care of Heating and Ventilating Magazine.

Wanted—Heating and ventilating engineer draftsman. Must have college education, be neat draftsman, capable of designing hot air, heating and ventilating systems. In reply state college, course and number of years attended, age, experiences, references, present salary and salary expected. Location, Eastern New York. Address Box No. 20, care of Heating and Ventilating Magazine.

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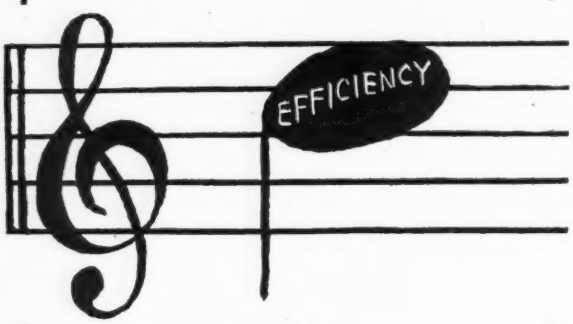

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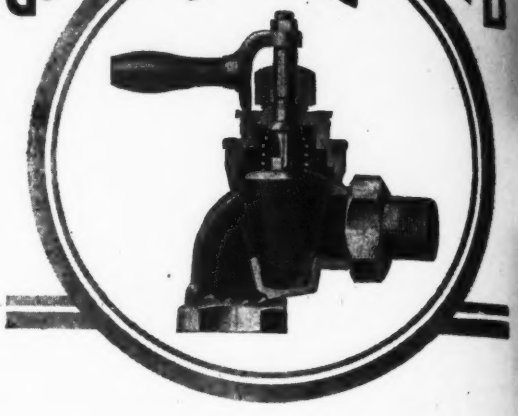

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